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Air Cargo:

How ARMY Experience Will Serve the Nation's AIR TRANSPORTATION in the POST-WAR Period

by Major-Gen. OLIVER P. ECHOLS
Assistant Chief of Air Staff for Materiel, Maintenance and Distribution

THE AIR TRANSPORT COMMAND, one of the three major commands under Gen. Echols' direction, is alone larger than the combined air transport organizations – civilian and military combined – in existence all over the world before the war.

Civilian air transport will have a valuable post-war legacy consisting of ATC and other Army Air Force experience and research gained during a period of unprecedented acceleration.

In this striking article – written specially for the *SAE Journal* – Gen. Echols gives practical, specific information about some of the items which will be included in that legacy.

THE Air Service Command started operating freight terminals requisitely located throughout the country at airports along the military air routes. Upon these terminals, air freight began converging from the suppliers by all known means of transportation. The terminals were in most cases improvised structures, such as World War I hangars, poorly equipped to receive goods from all types of conveyances. Indoors there was the problem of proper space and system in connection with the sorting of repacked articles according to destinations. Lastly, there was the necessity for docks for use in loading and unloading the airplanes. The ideal freight terminal, or the in-transit depot as it is termed in the Air Forces, has not yet been designed. However, we have come a long way with our "experimental" terminals such as the one just completed at Patterson Field, Fairfield, Ohio (Fig. 1). This depot has many new features, the most important of which would appear to be the dock arrangement on three sides permitting of close-in parking of a maximum number of airplanes loading or unloading at one time.

The question of the weight of a container in which an article was shipped by railway or surface ship was never given too much consideration. It was mostly a question of providing sufficiently strong packing to protect the contents. In air cargo, conversely, weight is the most important factor. In this field the Air Service Command has adopted standard reinforced paper cartons to replace the suppliers' wooden containers. These containers are used as packing for 90% of the freight shipped. They are reinforced by cloth binding on the edges and seams and are further strengthened by steel bands. In addition, those cartons destined for shipment to or through humid regions where dry in-transit depots are not available are sprayed with a liquid which makes them water-resistant. Reports from the Theaters show inconsequential damage or breakage and this form of packing express appears to be the solution to the weight problem.

An article packed in a wooden case arrived at an in-transit depot weighing 500 lb. This same article, repacked in a carton, was weighed before being loaded into a cargo airplane and weighed 200 lb.

Repacking in cartons (Fig. 2) effected a saving of 105 airplanes in four months on the basis of a payload of 5000 lb per airplane. Concentrated weight is still left in wooden cases, but very often these take the form of ingenious simplicity. Engines are loaded on to four-wheeled trucks

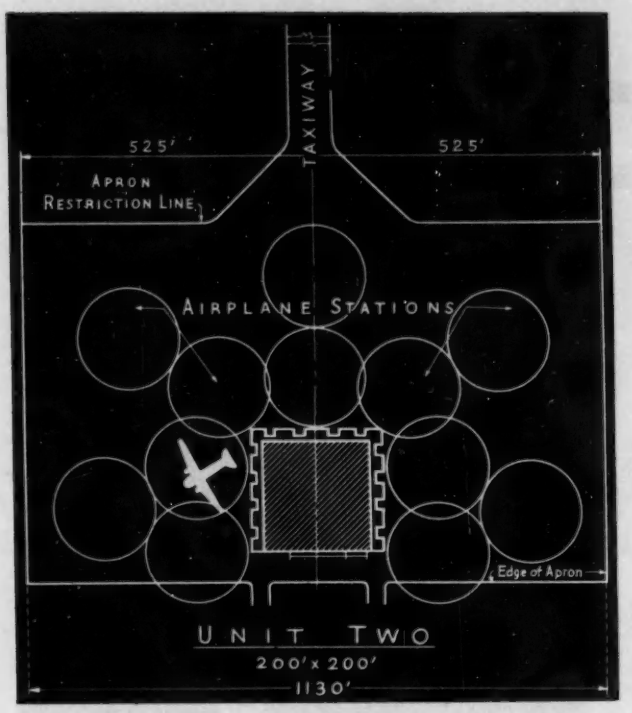

Fig. 1. Functional down to the last detail, this layout of the Air Service Command's has dock facilities on three sides. Circles indicate possible centering position of portable turn-tables (see Fig. 6)

equipped with a folding tongue and are made fast in the airplanes by simple devices which reduce unloading time at destination. These same trucks serve in the Theaters to ship engines back to our country for overhaul. Propeller blades are simply wrapped to protect the blade surfaces and when the hubs are included they are supported and protected by light wooden blocks.

The Air Service Command rarely handles two items alike when packing and loading a plane. A cargo (Fig. 3) could consist of a complete jeep, further loaded with small parcels once in place in the ship, steel drums, rolls of cable, sides of beef, airplane and motor vehicle tires, a compressor or lathe, and so forth.

One of the most difficult articles that has been handled, because it cannot be disassembled, is a Link Trainer (Fig. 4, panel). Because of its size and bulk it is slipped through the loading door with a clearance of less than an inch overhead. Once in the ship it must be well secured, for any necessary movements enroute would be detrimental to the delicate mechanisms.

In cooperation with commercial firms air cargo hold-down equipment has been developed by the Air Forces to provide safety to cargo, plane, and personnel and to save valuable man-hours in on and off loading. This equipment consists of a rope hook, a rope tightener (Fig. 2), coils of rope, a rope hanger, rods, beams, locks and jacks, and specially designed combination hooks. The rope hook eliminates knot tying and rope cutting. The rope tightener is a mechanical hand leverage which ties down cargo, eliminating slack. The coils of rope are 15 ft long, and the ends are whipped, for securing cargo. The rope hanger provides a simple method for hanging rope when not in use. The rods, beams, locks and jacks were developed to tie down all types of equipment in place of ropes, wherever possible. The specially designed combination hooks were developed for heavy equipment such as jeeps, guns, machines, powerplants, and so forth.

We began the war with planes designed for the carrying of passengers and cargo. The impressive air cargo transport records of the Air Forces and the commercial airlines are being made in passenger and bomber planes, changed and/or modified to make them adaptable to their new work. This means, nevertheless, that present-day cargo transportation is being accomplished with a degree of efficiency considerably below that which would conceivably characterize planes specifically built for cargo purposes. Converted B-24 Liberator bombers, for example, are doing excellent service as cargo planes; but these bombers are so constructed as to require that their loads be carried in a concentrated location. Lack of available loading within balance limitations both fore and aft of the center of gravity greatly limit their cargo load capacity, and the weights and balance officers who supervise their loading have to exercise great care in distributing weight, particularly toward the tail. Airplanes originally designed for passenger transportation, even though they are the newest models such as the C-54 and the C-46 and have greater

Fig. 2. Repacking from wooden boxes into cartons is standard practice for much of the Army's air cargo. Gross of 500 lb has been reduced to 200 lb, effecting the saving of 150 airplanes in four months on the basis of 5000 lb per ship. Simple heavy wire rope hooks (in floor tie-rings) eliminate knot-tying and rope-cutting, and are often used with another ingenious "skyloader" device – a heavy wire rope tightener (midway on near perpendicular rope)

Fig. 3. A jeep packed in with a miscellany of hardware and food secured for its battle-front destination

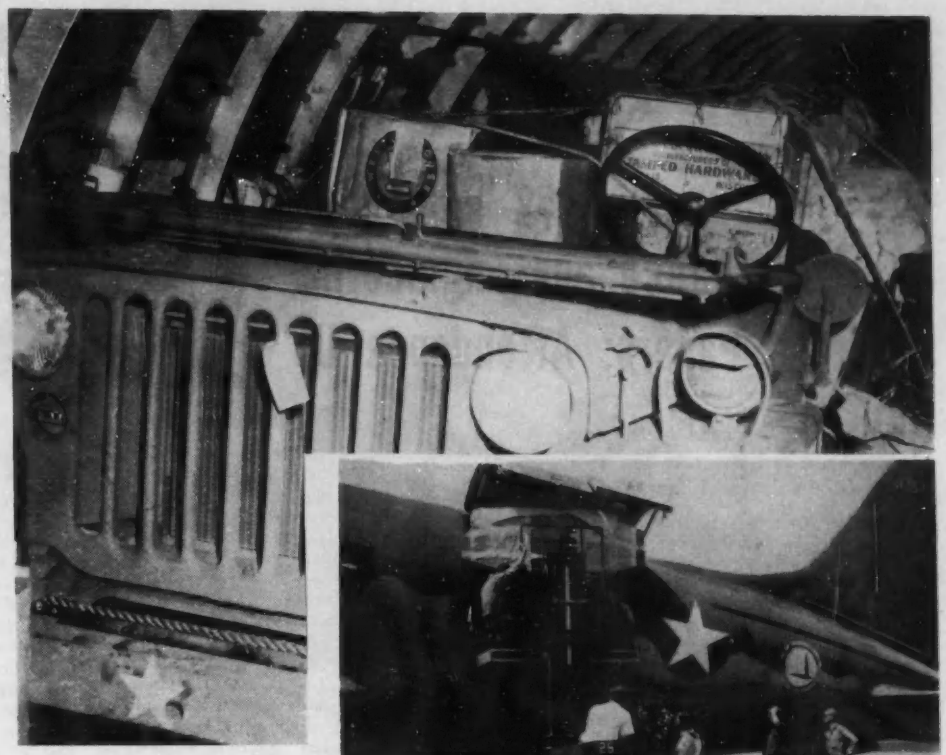

Fig. 4. Three stages of loading and securing a Link Trainer are shown in the panel to the right: Top view shows a lift-loader positioning the completely assembled unit at the proper level; center, moving the unit onto the floor, and below, securing the training unit

capacity and space than the bombers, are still far from ideal for the cargo-carrying work which they are performing so regularly. Loading facilities, doors, and cargo hold-down facilities are after-thoughts. They are frequently at locations that interfere with maintenance, and in other instances are too high for truck platform loading and inefficient as to structural weight. Ingenuity, rather than directives, has solved these problems when and where they have appeared.

The varied heights from the ground of the doors on the different planes have produced several pieces of loading equipment worthy of mention. There is the fork-lift plane loader alternately equipped with a bucket 4 x 6 ft forward, which has appeared in two models: the small-wheel hard-rubber-tire model for operation on hard surfaces; the jeep type with increased wheelbase, dual pneumatic tires in the rear and high ground clearance suitable for operation over terrain of any sort where aircraft or trucks may be operated. The latter model is the most versatile and weighs only 6390 lb. It is being used all over the world. Then there is the high-lift (11 ft lift) hydraulically-operated truck body mounted on a 10-wheel pneumatic-tired truck.

To facilitate and expedite the loading of jeeps, the jeep ramp (Fig. 5) has been developed. Likewise, the long mobile ramp for dock-to-plane loading has been developed at San Antonio.

Still another piece of equipment with which the Air Forces are experimenting is a 1200-lb portable turn-table for manipulating the planes into the desired positions for on and off loading (Fig. 6).

In so far as operations are concerned, there have been developments which could only have been advanced to their present stage under war or emergency conditions. In all but a few instances the developments effected by the Army Air Forces in the field of operations represent accelerated progress in connection with items known to avia-

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Report Aero Research

Los Angeles Meeting Dominated By Maintenance and Engineering Progress Papers; Attendance Up

RESEARCH and field maintenance problems and progress dominated the program of the SAE National Aircraft Engineering and Production Meeting, held in the Biltmore Hotel, Los Angeles, Sept. 30 and Oct. 1 and 2. This was the Society's Semi-Annual Meeting. Total registrations were slightly over 1700, attendance at the nine sessions was about double last year's.

Papers read at the nine conferences fell roughly into three classifications: research, production, and maintenance, with three listed under "production," two papers and the principal address of the convention falling under the "maintenance" heading, and the remaining eight classified as reports on research.

Highlight of the three-day meeting was a report on U. S. aircraft, direct from the fighting fronts, by Major-Gen. Delmar H. Dunton, deputy chief, Air Service Command, Wright Field, who had just returned from a tour of inspection that took him to every front where the U. S. AAF is operating. U. S. aircraft are better than the military authorities had any right even to hope they would be, the best in the world, but variations in supposedly interchangeable, identical parts is one problem not yet licked, Gen. Dunton reported. He said spare parts, supposedly identical, but manufactured by different companies producing the same bomber or fighter, vary so much it has become necessary when ordering to specify by which company the plane was made to obtain a replacement part that could be readily installed in the field. Stressing the complications this condition imposes, the speaker appealed to the aviation industry to bring about quick correction.

One highly controversial subject, hydraulic versus electrical control systems, on which differences of opinion had cropped up during periods of the first two days' sessions, was heavily deflated, as far as military planes are concerned, by Lt.-Col. G. C. Crom, Wright Field, who stated flatly that in military aircraft, subject to combat damage, the AAF prefers electrical controls wherever practicable.

Admitting that for certain functions hydraulic equipment is best, Col. Crom said that long hydraulic lines develop leaks that are difficult to locate and repair, and that combat damage too frequently puts an entire hydraulic system out of commission. Fifty per cent of electrical wiring can be—and infrequently is—damaged in combat, but with three-phase systems now in use, such damage seldom prevents operation of the equipment.

Another subject that was expected to precipitate interesting differences of opinion was "Interchangeable Powerplants," discussed at the Thursday evening meeting by a panel of five representatives of engine, airframe and airline companies. Breadth of the subject's wording precipitated a discussion so general that much of the "meat" it was hoped the arguments would bring out failed to develop.

Presentation of the SAE Manly Memorial awards, to Harry C. Karcher and John Dolza, both of the Allison Division, General Motors Corp., for their technical paper on "Correlating Ground and Altitude Performance of Aircraft-Engine Oiling Systems," added human interest to the Friday night general session. Robert Insley, of the Memorial Committee, made the presentations. Both recipients commended the wholehearted cooperation and interchange of valuable research information in the aviation industry.

C. L. "Kelly" Johnson, Lockheed Aircraft Corp., opened the Friday night general session and introduced SAE President Mac Short, Vega Aircraft Corp., who conducted the preliminary business session, introducing official representatives, J. H. Sidebottom of the Aeronautical Chamber of Commerce of America, Thomas Wolfe of the Air Transport Association of America, Harry Woodhead of the National Aircraft War Production Council, Inc., and Mr. Insley. President Short also read messages of congratulation on the Society's contribution to U. S. aviation developments from Gen. Henry H. Arnold, commander of the AAF, Rear-Admiral DeWitt C. Ramsey, chief of the Bureau of Aeronautics, Navy Department and James P. Murray, president, Aeronautical Chamber of Commerce of America. Mr. Woodhead, session chairman, introduced Gen. Dunton.

Highlights of the General's talk were these statements: Americans are instinctively the greatest mechanics on earth . . . victory is certain . . . only now is the U. S. beginning to reap the benefits of over two years of war effort . . . there are 380,000 items on the AAF materials procurement lists . . . aviation engineers should simplify design to achieve simpler maintenance in the field . . . we (U. S.) are manufacturing the finest aircraft in the world . . . we didn't know (when we designed them) they would be as good as they are.

The Thursday evening meeting, devoted to a panel discussion on "Interchangeable Powerplants," was chairmanned by Mr. Johnson, who also acted as discussion leader. On the panel were Harry Karcher, Allison Division, General Motors Corp., Rudolph

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C. L. Johnson, general chairman of the 1943 SAE National Aircraft Engineering and Production Meeting (left) with SAE President Mac Short, Major-Gen. Delmar H. Dunton, principal speaker at the banquet, and Harry Woodhead, toastmaster

VITAL WAR ROLE of FARM MACHINERY STRESSED at RECORD TRACTOR MEETING

INTENT on building the maximum possible quantity of tractors and farm machinery to produce the huge amount of food required by this country and her allies, close to 500 tractor engineers gathered at the Schroeder Hotel, Milwaukee, Wis., Sept. 23 and 24 for the SAE 1943 National Tractor Meeting. Co-operation between industry and Government in attaining these objectives was the keynote of the meeting.

The Government's attitude was voiced by three high-ranking Washington officials who spoke to a capacity audience at the dinner on Sept. 23. It can best be expressed in the words of J. A. Krug, WPB vice-chairman and director, Office of War Utilities, principal speaker at the dinner:

"Everyone in the various war agencies in Washington is appreciative of the vital need that the farm machinery production program be met."

Mr. Krug assured his audience that the War Production Board would render every possible assistance in seeing that the necessary materials and component parts keep flowing to the production lines of all tractor and farm machinery builders. "The real job, however," he emphasized, "is in your hands – organizing production and getting the help of suppliers who are not already overloaded.

"The basic reason for our success in the Pacific," Mr. Krug concluded, "is that we are moving material and blazing our way with mechanized equipment. We use tractors and bulldozers while the Japs hack trails through the jungle by hand."

Earlier speakers on the dinner program were A. A. Stone, head of the Farm and Machinery Division of the OPA, and Walter Lloyd of the Transportation Food Requirements Division, Department of Agriculture.

C. G. Krieger, SAE vice-president representing Tractor and Farm Machinery Engineering, and director, Farm Machinery and Equipment Division, WPB, was chairman of the dinner and J. B. Fisher, Waukesha Motor Co., was toastmaster.

The four technical sessions held during the two-day meeting dealt with four of the tractor engineer's most perplexing problems during the present emergency, namely bearings, fuels, tires, and steels. Long and spirited discussion followed presentation of papers on each of these subjects. Another paper related the progress made so far by the SAE Tractor War Emergency Committee in solving wartime problems dealing with the design and production of tractors and farm machinery.

Success of this, the largest SAE National Tractor Meeting on record, is due largely to the efforts of the Tractor Activity Meetings Committee comprising Walter F. Strehlow, Allis-Chalmers Mfg. Co., chairman, George Curtis, Timken Roller Bearing Co., and Lester S. Pfost, Massey-Harris Co.

C. G. Krieger, director, Farm Machinery & Equipment Division of WPB and SAE vice-president, Tractor & Farm Machinery Engineering (left) with J. A. Krug, director of War Utilities and vice-chairman of WPB, who was dinner speaker, and James B. Fisher, vice-president of Waukesha Motor Co., toastmaster of the dinner

Operating Conditions Used To Select Tractor Bearings

A method of selecting satisfactory bearings for the transmissions and final drives of pneumatic-tired tractors that depends on a knowledge of average operating conditions, was reported by John Borland, Timken Roller Bearing Co., in the paper read at the first technical session after Session Chairman Elmer McCormick, John Deere Tractor Co., had opened the meeting.

The well-known method of rating bearings on a fatigue basis is, according to tests carried out by Mr. Borland, a reasonably accurate way of predicting bearing life when loading conditions are definitely established. However, the tables that have been compiled by the bearing manufacturers are satisfactory for determining bearing life only of bearings subjected to a constant load at a constant speed.

Since tractor transmissions are subjected to as many different loading conditions as there are speed changes provided in the tractor, tractor transmission bearings cannot be selected directly from these tables. They must be used in conjunction with the formula for determining a factor called weighted life. This formula takes into consideration the life factors of the bearing at the different loads and the per cent of time for which each factor applies.

Various methods have been devised for calculating bearing loads in tractor transmissions that have resulted in bearing selections giving satisfactory field service. None of these methods, however, has given a true picture of actual field loads encountered on tractors using pneumatic tires.

To make a thorough analysis of bearing life in a tractor transmission, it is necessary to know the per cent of time the transmission is used in its various speeds and the per cent of motor power normally going through the transmission in each of these speeds.

The tractor manufacturers consulted by Mr. Borland were in fairly close agreement as to the per cent of time in which the tractor is used in the various speeds, but they were not in such accord concerning the amount of power going through the transmission. Practically all the engineers agreed, however, that it is incorrect to figure bearing loadings from the peak motor power, most of them believing that, in so far as transmission bearings are concerned, the correct method would be to figure back from the drawbar pull, and that the weight of the tractor controls the drawbar pull that can be developed on a pneumatic tired unit.

To calculate bearing loads by the author's method, it is necessary to know the weight of the proposed tractor in operating condition, including the operator and water in the rear tires; the speed in each gear; and the tire size. The tangential force on the rear wheels in each speed can be obtained in terms of per cent of total tractor weight from a curve derived by Mr. Borland from the data he collected. This tangential force on the rear wheels multiplied by the rolling radius will give the torque on the rear axle. From this torque, the bearing loads can be calculated.

Mr. Borland also discussed other factors that have an effect on bearing life in addition to the imposed loads.

Discussion of Borland Paper

"Pneumatic tires on tractors have placed these units in the vehicle class – so predictions, such as just given by Mr. Borland, can be made," pointed out B. W. Keese, Wisconsin Axle Division, Timken-Detroit Axle Co., reading from prepared discussion. "Unlike the truck, however," he continued, "gross overloads are not possible. There is further safety in Mr. Borland's analysis in that he bases his predictions upon the Nebraska tests where the entire tractor is under the nearest to perfect adjustments, the motor tuned up to dynamometer accuracy, carbure-

tion at its best, and ground conditions closest to ideal. It is doubtful if many farmers could duplicate these conditions in the field, and then not for long, as carbon deposits in the engines soon eat off some of the peak performance." Mr. Keese went on to emphasize that the life of a tractor is not an easy one for it is under steady pull, seldom coasts, and has a work cycle all its own. Deflection, he believes, is "a grave responsibility for any designer." Other pertinent factors covered by Mr. Keese included tire slippage, lubrication, shot peening, and cold working.

Factors Substantiated

"Past performance and life results of known designs, in general, substantiate the correctness of the factors proposed in Mr. Borland's paper," pointed out L. A. Bixby, Clark Equipment Co., the second to present prepared discussion. Methods previously used for calculating bearing life for farm tractors, he said, have resulted frequently in the recommendation of oversize bearings which were out of proportion to the rest of the unit. In many cases it became necessary for the designing engineer to assume the responsibility of selecting a bearing which calculations did not indicate was of sufficient capacity, in order to propose an economical and consistent bearing and gear layout in the development of his general design. This has been done many times and has left much to the imagination and judgment of the axle and transmission engineer. By using Mr. Borland's suggested procedure, Mr. Bixby concluded, we have a yardstick based on facts which can be used to check our judgment, thereby giving a definite means for insuring the most economical bearing selections.

At this point Chairman McCormick pointed out the bearing difficulties that have been experienced when tractors designed for rubber tires had to be run on steel wheels.

Non-Average Tractors

Noting that Mr. Borland's paper was based on average conditions, W. Henning, International Harvester Co., emphasized that it is not the "average-condition" tractors that give trouble – it is the 10 or 20% that are worked hard. Reducing the size of bearings in these, he suggested, might result in more trouble in the field. Mr. Henning also pointed out that smaller bearings mean smaller shafts and asked Mr. Borland what he considered to be the maximum permissible misalignment or deflection condition since the life of the bearing is dependent upon the deflection.

In reply, Mr. Borland suggested that it might be better to make special allowances for the 10 or 20% of heavily loaded tractors than to penalize the majority by designing all on the basis of this hard-working minority. As for maximum permissible deflection, he recommended an out-of-line value of 0.005 in. per in. of bearing spread.

The question of average life of tractors was raised by several discussers. Chairman McCormick reported in reply that 5000 hr had been used – but that this value seemed low during present conditions. Others pointed out that the average life a tractor is designed for is a function of the individual tractor designer and, hence, may vary widely.

"Although all parts in the ideal machine should fail at the same time like the one-horse shay," contributed H. N. Parsons, International Harvester Co., "we believe that the bearing is the foundation of the machine and, consequently, should be the last to go."

Post-War Octanes Higher But Well Under 100

"Newspaper publicity to the contrary, it is highly improbable that motorists will be able to fill up on 100-octane gasoline at any post-war service station," contended T. H. Risk, Ethyl Gasoline Corp., speaking on the subject: "Post-War Motor Fuels." His talk was the feature of the second technical session of which O. R. Schoenrock, J. I. Case Co., was chairman. "Even if 100-octane gasoline were readily available," Mr. Risk continued, "motorists would be disappointed with the way it would work in their engines."

Defining the requirements of a satisfactory motor fuel, Mr. Risk stipulated that it must be plentiful, cheap, easy to vaporize, high in energy content, and free from knock.

The nature of post-war motor fuels, he pointed out, will depend largely on how the refining industry utilizes the various left-over high- and low-octane components of aviation fuels. He showed by means of charts that there are approximately twice as many constituents available now as before the war and that these constituents are of higher average octane number.

Comparing the various methods of knock rating now in use, he brought out that the borderline knock method brings in the effect of speed. By means of borderline knock curves he pointed out that many fuels with a high knock rating at high speeds may have a low knock rating at low speeds, and vice versa. Also he showed that different types of engines and different engines of the same type rate fuels differently.

As a background for predicting post-war octane ratings, Mr. Risk showed, by extrapolation of curves showing the yearly octane-number increases, that, if there had been no war, the octane number of regular gasoline would have reached 79 by 1944, and premium fuel would have climbed to 83 by next year.

Mr. Risk concluded his discussion with the prediction that the regular grade of post-war gasoline would be about 78 octane number Motor Method (85 to 87 Research Method) and premium-grade octane number would be about 85 Motor Method (95 Research Method). He qualified his prognostication by repeating that the final result depends upon a number of imponderables, such as the nature of post-war cars, refinery economics, ratio of premium-grade to regular grade gasoline, and how much aviation fuel will be used after the war.

Discussion of Risk Paper

Support for Mr. Risk's predictions came from the first discusser, C. M. Larson, Sinclair Refining Co., who reported that definite work along similar lines bears him out. During each of this country's last three wars, he pointed out, the petroleum industry has made outstanding progress. Out of the Spanish-American War came kerosene and naphtha; out of World War I came motor fuels; and, during this war, aviation gasolines are reaching their highest development.

An important reason why the RAF was able to defeat the *Luftwaffe* in the Battle of Britain, he explained, was because the RAF was using 100-octane gasoline while the Germans were using lower-grade fuel. Today some 100,000 United Nations planes are using 100-octane fuel which, only a few years ago, was still under development in laboratory test tubes. Since the last war, he continued, cruising speed fuel consumption of aircraft has been cut in half.

Mr. Larson then gave his ideas of what post-war fuels for ground vehicles would be

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Prominent at Tractor Meeting

Albert W. Lavers, chief engineer, Minneapolis Moline Power Implement Co. and chairman, Tractor War Emergency Advisory Committee (left) with W. F. Strehlow, chief engineer, Allis-Chalmers Mfg. Co., chairman of the Meeting Committee

Aluminum Alloy FORGING DIES: Considerations in Their Design and Use

by R. F. DUFF,

Ford Motor Co. and Chairman, SAE Design Subcommittee, Aluminum Committee, SAE War Engineering Board

THE Die Design Subcommittee of the Aluminum Committee of the SAE War Engineering Board has issued a report on precautions to be taken in the designing and use of dies in the production of aluminum alloy forgings.

Investigations of this committee have revealed that certain fundamental procedures should be followed if maximum die life and satisfactory forgings are expected. The improper use of dies and the use of improperly designed aluminum alloy forging dies, both hammer and hot press, may result in blistered forgings and shortened die life.

Among reasons for rejection of aluminum forgings has been the formation of blisters on the surface of the metal, particularly on the commercial alloy 14S. Blisters may result from any of the following causes:

Overheating in the heat treat process,

High temperature oxidation,

Defects in the forging bar stock or Improperly designed dies.

This committee found that blisters developed on aluminum alloy forgings when the metal was worked too rapidly and generated excessive frictional heat (see Fig. 1). The addition of fullers to the dies, slower, lighter hammering, proper use of lubricants and good die finish eliminated, to a great extent, blisters from this source.

In making an aluminum alloy forging and laying out the die for it, the first consideration is the size of the stock to be used. Aluminum does not gather to the same extent that steel does and, therefore, must be approximately as large as the greatest cross section of the forging. The details of aluminum forging and die design have been discussed recently in another publication.* However, there are certain fundamentals that cannot be emphasized too strongly:

The finish impression should be placed as near the center of the die as possible;

The impression cut so the metal flow of the forging would be at right angles to the grain flow of the die block;

The amount of work done in each step equally proportioned so that there is not excessive wear in any one step.

It is also necessary to leave ample edge distance. Fig. 2 shows a typical example and Fig. 3 shows the various steps from the rough stock to the finished product. Figs. 4, 5 and 6 show edging, fullering and finish operations respectively.

If the die is not properly lubricated, the friction developed between the forging die block and the forging material will cause blisters as well as produce a rough exterior finish on the forging. A satisfactory lubricating mixture would consist of a high-viscosity oil combined with a low-viscosity oil in such proportions that it has high friction-

* *Iron Age*—June 17, 1943.

SOLVING production problems found in attempting to mass-produce millions of aluminum alloy forgings for modern weapons was a typical byproduct of the SAE War Engineering Board, which was formed before Pearl Harbor to make engineering studies for the Army, Navy, and Government civilian war agencies.

The author cites the work of his committee and the consultants, named below, as being responsible for this article which details steps necessary to produce aluminum alloy forgings in quantity.

SAE-W.E.B. Aluminum Subcommittee:

R. F. DUFF, Ford Motor Co., Willow Run, chairman;
PAUL SCHOEN, Bohn Aluminum & Brass Corp.;
HARVEY CURTIS, Dodge Forge Division, Chrysler Corp.;
SHERRY O'BRIEN, Harvey Metals Corp.;
L. W. DAVIS, Aluminum Co. of America; and
C. L. FOREMAN, Buick Division, General Motors Corp.

Consultants to Subcommittee:

C. CAMPBELL, Chevrolet Division, General Motors Corp.;
PAUL VENSKE, Harvey Metals Corp.;
E. LANG, Heppenstall Steel Co.;
H. GRAHAM, A. Finkl & Sons;
CLARENCE BENSON, CHARLES STURZA, and WILLIAM ACRE, Ford Motor Co., and A. G. STECKER, Ford Motor Co., Willow Run;
E. H. STILWILL, Chrysler Corp., and
ROBERT DARNTON, Buick Division, General Motors Corp.

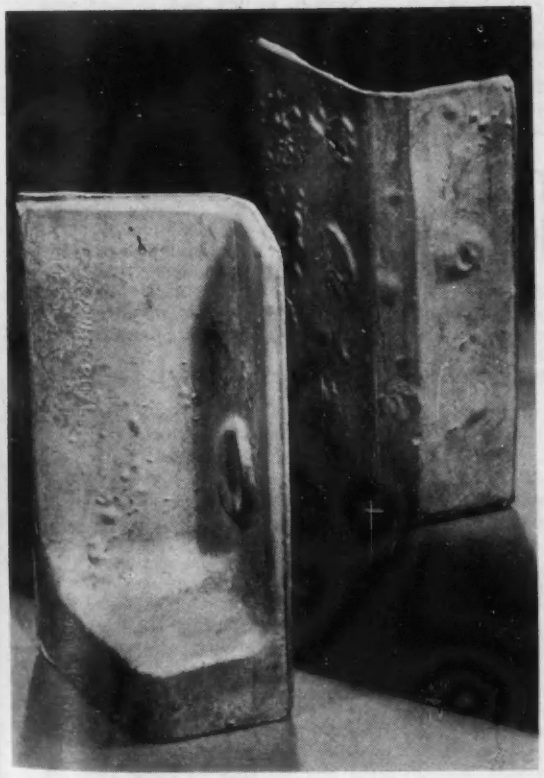
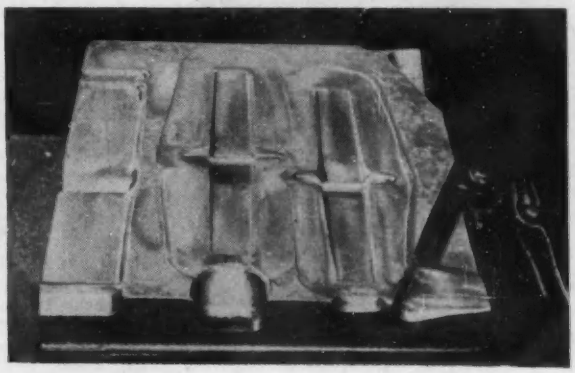


Fig. 1 (Left): Effect after heat treatment of panel splice fitting over-heated in the forging operation. Forging is of 14ST aluminum alloy

Fig. 2 (Below): Typical example showing ample edge distance



reducing properties, a high film strength (with the least amount of oil and graphite deposited on the die surfaces), and non-explosive properties. The low viscosity oil may be any solvent that will have a thinning action on the heavier oil, allowing it to spread freely over the die surface. A typical die mixture is 50% lard oil plus 50% distillate. Sometimes a small amount of graphite is added. Many other lubricants are used such as plain mineral oil, lard oil, peanut oil, castor oil, graphited oil and other incorroding mixtures of the above. The high viscosity oil is the actual lubricant, and graphite, in small quantities, is sometimes added to help reduce the friction. The lubricant may be applied with either a spray, swab or air blast. If graphite is used in the spray it must be sufficiently agitated to prevent the nozzle from plugging.

The material used for making the die block is the same as that used to produce steel forgings. Performance records are usually lower when making aluminum forgings than when making steel forgings. However, it is possible that a new material that lends itself to the peculiarities of aluminum forging may be developed.

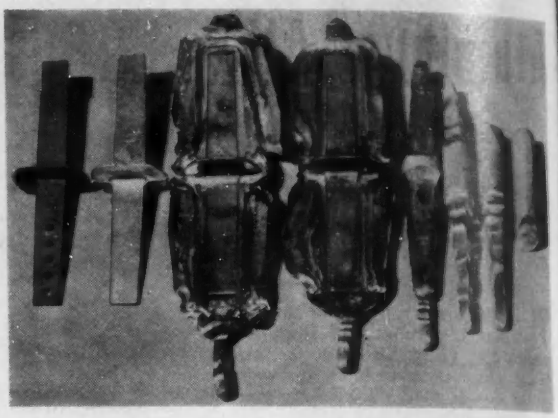
Dies for aluminum alloy forgings are usually purchased in the heat-treated condition. The hardness will vary with the type of work being done. There seems to be a direct relationship between the depth of the impression and the hardness of the die. On forgings having wide, thin webs, the best results may be expected with a Shore hardness of 55 to 60. A forging die for the average forging should have a hardness of 48 to 51. Large dies, particularly those having deep impressions, are found to work very satisfactorily at Shore hardnesses of from 43 to 48. Press dies are usually found to have Shore hardnesses of 55 to 60. In some cases, there may be hardnesses up to 65 with good results. Stress relief after periods of use seems to increase die life in some cases.

Fig. 4: Edging operation on rough aluminum alloy stock

Fig. 5: Fullering operation

Fig. 6: Final forging operation on wing hat stringer splice

Fig. 3: Various stages from the rough stock (R.) to the finished wing hat stringer splice No. 32W040 14ST aluminum alloy forging (L.) as produced at the Ford Willow Run plant



Dies can be easily injured and their life shortened by improper use in the shop. All dies should be pre-heated slowly and uniformly to a temperature between 250 and 400 F before making forgings. The use of cold dies is probably one of the greatest factors encountered in die breakage. The first 50 to 100 blows on each new set of dies should be taken lightly. A die should be used for as long a run as possible. It has been found that by using die blocks of the same material to produce the same forging, it is possible to run 3000 to 10,000 pieces if run at one time, whereas, if the die is taken down and re-set at 500-piece intervals the die life is usually shortened to 2000 or 5000 pieces. Needless to say, every care should be exercised to see that the dies are properly aligned with the bed of the machine and with themselves.

The aluminum forging stock must be heated uniformly throughout for best results to die life. Working cold material in dies causes extensive wear and early failure and will also result in erratic physical properties in the forgings.

The finish on dies is an important factor in die life. All dies must show a surface smoothness which is characteristic of the best forging die practice. This bears no reference either to profilometer readings or to other surface measuring devices or to any characteristic of flatness or contour. The requirement is based on the complete absence of angular, irregular surfaces. The final finish of die preparations must be carried out in such a manner that the polishing marks will follow the direction of material flow. Irregular, oriented marks and whorls on the die surface, and so forth, must be avoided.

The thickness of the flash must be such as not to restrict the flow of metal. Thin flashes are more readily and economically trimmed, but for the best die life flashings of about 0.040 in. are indicated.

Other very common causes of die failure are cracks resulting from the explosion of the die lubricant in the corners and angles of the impressions and continued over-stress of the steel at these locations during the forging operation.

Regardless of the precautions taken in designing the die and operating the shop, the human element remains probably the greatest factor in producing good forgings and reasonable die life. Willful misuse and mishandling of dies, such as misaligning them in the machine, striking them too hard, subjecting them to extremes in temperature and improperly applying lubricants, all have a direct bearing on die life and the quality of forgings produced.

Aluminum Forging Technique Advanced

EXTENDED use of extruded aluminum alloy stock in airplane and other arms production, in order to conserve aluminum forging stock, is made possible by the extensive study just completed by the Subcommittee on Metallurgical Problems of the Aluminum Committee of the SAE War Engineering Board. This group, headed by P. P. Ziegler, Reynolds Metals Co., is one of four which were assigned specific problems by the Aluminum Committee, of which Louis Thoms, General Motors Corp., is W.E.B. sponsor.

Although earlier practice indicated that forgings made from extruded stock were more subject to blistering, resulted in excessive cracking in the coarse grain region or at the interface between coarse and normal sized grains during forging, or cracking in the coarse grain areas during solution heat treatment and quenching, the investigation of the subcommittee found that current practice, with improved extrudings, is generally satisfactory.

A study of the effects of chemical composition on physical properties of 14 S-T forgings showed that entirely satisfactory physicals can be obtained from extruded 14 S using a nominal silicon content of 0.90% in its nominal composition.

With impurities controlled by Federal Specification QQ-A-367b, the following composition of 14 S was recommended:

Si	Cu	Mn	Mg
0.90%	4.40%	0.80%	0.40%

Leading producers have agreed to control the chemicals of their 14 S forging stock, both rolled and extruded, in accordance with this recommendation of the subcommittee.

When a number of aluminum alloys are extruded or rolled, two different grain structures are obtained. In 14 S forging stock, for example, the structure is only partly modified by thermal treatment, with the result that abnormally high mechanical properties appear in the extruded stock after solution and artificial aging heat treatments.

Normal forging operations cause more recrystallization during solution heat treatment. Therefore, the subcommittee pointed out, both lower tensile and yield strengths and greater elongation are secured in the

turn to page 36

Los Angeles Meeting Dominated By Maintenance and Engineering Progress Papers; Attendance Up

continued from page 20

George R. Sanborn, Boeing Aircraft Co., who spoke on combat area servicing (left), Reagan Stunkel, chairman of the Field Maintenance Session, W. C. Gould, Allison Division, General Motors Corp., co-author with C. R. Paton of a paper on field service problems

Wallace, Pratt & Whitney Aircraft, Division United Aircraft Corp., J. C. Duffendack, Lockheed Aircraft Corp., Ivar Shogran, Douglas Aircraft Co., Inc. and E. A. Boniface, American Airlines, Inc.

In presenting the subject, Chairman Johnson asked the panel's view on "power egg" engines suitable for installation on all types of planes using that horsepower rating. He briefly listed several possible disadvantages and then quoted from a two-part series in *Aviation* for September and October, 1943, by Dr. Stanford Moss, titled: "The Case for the Integral Powerplant" in citation of advantages.

The engine firm representatives presented the affirmative and were opposed by the airframe men with the airline representative willing to accept power eggs *if* they did not impose weight penalties that would offset the advantages from an operator's standpoint.

When arguments appeared to ignore Chairman Johnson's qualification . . . "suitable on all types of planes using that horsepower rating," Wing Commander P. McDiarmid of the RAF, who spoke from the floor, briefly outlined British experience with power eggs and called attention to the fact that adoption of such standardization did not reduce the choice to the extent implied in some of the views expressed, but did reduce considerably the number of types of engines previously manufactured. British experience, he indicated, was favorable to the limited adoption of such standardization.

Field Maintenance Session

Chairman Reagan Stunkel's session drew an attendance of almost 500 and was enlivened by a sudden flare-up of the hydraulic-versus-electrical controls controversy, when one speaker reported that in the field mechanics told him they preferred electrical to hydraulic systems.

In his paper on "Aircraft Service in Combat Areas," George R. Sanborn, Boeing Aircraft Co., cited numerous difficult field servicing problems encountered by himself and other field service representatives. He recommended modifying present designs for easier service in the field, urged courses for engineers and production men on "design for maintenance" in the plants, and said interchangeable parts on small mechanisms manufactured by different companies would be of great advantage. In answer to a question, he said that the British system tends to unstandardize planes and their parts.

Clyde R. Paton and William C. Gould, Allison Division, General Motors Corp., reported on "Servicing Military Aircraft in Overseas Theaters." They have observed field service in most of the combat areas of this war and presented brief descriptions of typical bases in those areas, stressing the problems caused by climate, humidity, dust, ability of native labor, and availability of supplies and parts. To overhaul the average radial engine, using native labor, requires 800 man-hours in one of the better-equipped Middle East bases. Accompanying the paper, read by Mr. Gould, was an RAF film, "Give The Enemy No Rest," and slides showing facilities available and problems encountered. Despite seemingly insurmountable difficulties and almost incessant combat, the speaker said, the rate of attrition in most theaters has been lower than was originally anticipated. They recommended that a service representative of the aircraft manufacturer be stationed at the last point in the U. S. from which aircraft leave the country to insure that a complete set of operating instructions is installed in each ship, and that necessary tools and certain spare parts are included with crated planes.

Mr. Gould's statement that mechanics in the field had expressed a preference for electrical rather than hydraulic systems precipitated the first flurry of the convention on this controversial subject.

Aircraft Propeller Session

Two papers were presented at this session with A. L. Klein as chairman, and both were well received.

A paper on "Flight Testing With a Propeller Thrust Meter" by George Brady, Propeller Division, Curtiss-Wright Corp., discussed thrust meter design, calibration, flight instrumentation, and procedure, test results, body-propeller interaction; and summarized the usefulness of the thrust meter. It concluded with the observation that use of shaft thrust measurements in routine flight testing to check calculated airplane performance does not appear very practicable until additional data by which the several corrections can be more accurately determined have been obtained. The thrust meter, however, does have important value in determining the relative efficiency of different propellers.

W. L. Greene and A. R. Crocker, Engineering and Research Corp., discussed "Analysis of Captured Composite Propeller Blade," in a paper which reported findings of a study of a composite wood, plastic, and metal blade combining parts of the Schwarz and Jablo processes. After discussing constructional details, aerodynamic characteristics, and materials composition, the paper concluded with this appraisal: This type of construction resulted in a much lighter blade than any metal blade of the same diameter and activity factor. Considering the operating top speed and the thickness of the airfoil sections, it is probably the aerodynamic equivalent of most metal blades. However,

Spoke at Interchangeable Powerplants Session

Leader and speakers of the Interchangeable Powerplants session were C. L. Johnson, Lockheed Aircraft Corp. (L); Harry Karcher, Allison Division, GMC; Ivar Shogran, Douglas Aircraft Co., Inc.; Rudolph Wallace, Pratt & Whitney Aircraft; J. C. Duffendack, Lockheed Aircraft Corp., and E. A. Boniface, American Airlines, Inc.

the construction is quite complicated and probably required more time to build than would be the case of metal blades other than steel.

Aircraft Engines Session

Two papers, presented under the chairmanship of T. F. Bergmann, attracted a large audience which asked many questions indicating widespread interest in auxiliary powerplant developments and the use of high-speed photography in motion analysis.

H. D. Jackes, Wright Aeronautical Corp., reported on "Motion Analysis by Means of High-Speed Photography," recounting the limitations of stroboscopic methods, and the advantages of high-speed photography. The paper suggested possible additional uses of the newer method, and concluded with a proof-of-the-pudding showing of 14 short, impressive motion picture studies of almost as many subjects that presented findings.

"Auxiliary Powerplants" was the subject presented by Blake Reynolds, Lawrance Engineering & Research Corp. The author reviewed the development of auxiliary powerplants, illustrated with citation of several of the problems overcome, and predicted interesting developments in this field when the war is over. He predicted that auxiliary powerplants will be standard equipment on many large and small planes, after the war, but admitted there are a large number of problems still unsolved in their design and manufacture.

Aircraft Accessories Session

A record crowd of more than 600 assembled for the first meeting of the second day, expecting interesting verbal fireworks during the audience participation period following the hydraulic-versus-electrical-systems papers. They heard an intensely interesting and highly informative paper on "Altitude Vapor Formation in Aircraft Fuel Systems" and two on the controversial subject. When it was all over it was discovered that much of the anticipated excitement had failed to materialize. Gunnar Edenquist was chairman.

W. H. and R. R. Curtis, Curtis Pump Co., discussed "Altitude Vapor Formation in Aircraft Fuel Systems." They explained the equipment and procedure followed and commented on the six test runs from which data were taken for the paper. Conclusions included the following: The operation of a centrifugal fuel booster pump properly installed will reduce the vapor potential of the fuel in the system on the discharge side of the booster; use of an electric motor-driven fuel pump at any point in the fuel line between the fuel tank and the engine fuel pump has no effect upon the altitude at which vapor may appear in the carburetor, neither does it reduce the volume.

"Comparison of Hydraulic and Electrical Accessory Systems in Aircraft" was presented in two parts by W. C. Trautman, Bendix Aviation Ltd., and R. E. Middleton, Aircraft Accessories Corp. The authors confined it to (1) a comparison of the individual components of each system on the basis of weight in pounds per horsepower at various horsepower ratings and at efficiencies which are commonly used in aircraft practice, and (2) a comparison of typical hydraulic and electrical accessory power transmission systems designed to perform an identical job on a modern airplane.

Comparisons were confined to 28-v, direct-current electrical systems and 1500-psi hydraulic systems. Items compared were power generating devices, power transmission systems, directional controls, and power application devices. Comparisons were made at ambient air temperatures of +60 F.

The conclusions drawn conceded that electrical energy is required for lighting, radio, and so forth, and that hydraulic power is much superior for such functions as brake control and other operations that require delicate, smooth and accurate control. Both systems have advantages for particular uses and should maintain their rightful place in aircraft.

Audience participation centered on weight comparisons and developed considerable good-natured dueling as spokesmen sought to deflate each other's cases. Verdict of the bouts were a no-decision draw.

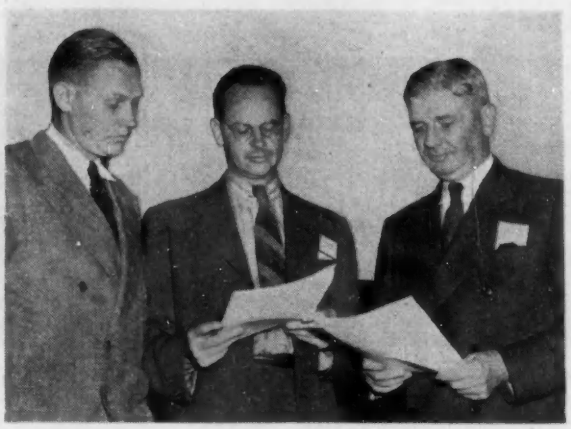
Aircraft Production Session

A year of progress, since the 1942 SAE National Aircraft Engineering and Production Meeting, also held in Los Angeles, was reflected in the smaller part given to aircraft production, as such, on the program of the 1943 meeting. Maintenance loomed larger and, of course, research provided the major portion. For the lone session devoted to aircraft production, two excellent papers had been prepared, one of them accompanied by a sound film telling the story of North American's manufacture of its Texan trainers.

"Scheduling of Changes in Aircraft Production" was described by H. S. Martin, Consolidated Vultee Aircraft Corp. Changes, he said, were probably one of the aviation industry's most difficult wartime problems. They were segregated, for purposes of more orderly discussion, into four groups based upon the nature of their origin: safety, military necessity, production improvement, and

Winners of Manly Medal, 1942

Harry Karcher (left) and John Dolza (center), of Allison Division, General Motors Corp., receiving the Manly Memorial Medal from Robert Insley, Continental Motors Corp., chairman of the Board of Award. First to be made since 1939, this award recognizes the excellence of a technical paper, "Correlation of Ground and Altitude Performance of Oil Systems," presented June 8, 1942, by the medalists as co-authors before a joint meeting of SAE Detroit Section and Engineering Society of Detroit. The medal honors the late Charles M. Manly, SAE president and designer of the prototype of modern radial engines for aircraft. It is available for award annually to the author of the best technical paper on aeronautical powerplants, parts, or accessories presented during the year before an SAE meeting



Ralph Ruud, North American Aviation, Inc. (left), who described the trainer series, with Arthur E. Raymond, chairman of the Aircraft Production Session, and H. S. Martin, Consolidated Vultee Aircraft Corp., who discussed scheduling changes

miscellaneous. General rules followed by the author's company were given as follows:

Safety – made as soon as possible.

Military Necessity – made as soon as possible and still maintain scheduled deliveries.

Production Improvement – as soon as possible without delaying deliveries, or causing scrappage of parts, and

Miscellaneous – when practicable.

The system described endeavors to provide a means for scheduling changes which is simple and which, in large part, makes the departments concerned responsible for seeing that schedules are maintained.

Ralph Rudd, North American Aviation, Inc., presented a paper on "Design and Development of the North American Aviation Trainer Series." After pointing out that the North American trainer, unlike most combat airplanes, can be discussed with complete freedom, the paper told the history of the design, the reasons for its particular type of fuselage, wing, engine, and tail section, and then discussed such manufacturing matters as the use of high-speed radial arm routers, radial drill arm, rubber-pad hydraulic press, drop hammers, and machining methods. Production methods were shown in the film which followed.

Powerplant Installations Session

Chairman John Young's session offered a paper on "Carburetor Air Pre-heat Requirements," by W. C. Lawrence, American Airlines, Inc., and its content was considered by military authorities to be of such military value no report on it was permitted.

Aircraft Session

Two papers were given at the final session under the chairmanship of A. M. Schwartz. They were well received by an intensely interested audience. The second paper was followed by an industrial film on proper methods of handling and working magnesium alloys.

The first paper on "Use of Generalized Coordinates in Flutter Analysis," by Samuel J. Loring, Chance Vought Aircraft, Division United Aircraft Corp., was the longest and most detailed presented at the three-day meeting. It is recommended that those needing this information obtain copies from SAE headquarters, 29 W. 39th Street, New York 18, N. Y.

"Experience with Use of Magnesium in Aircraft" was reported on by J. C. Mathes, Dow Chemical Co. Highlight of this thorough paper on the various types and uses, methods and precautions for obtaining best results from magnesium alloys was the report on the effects of gunfire on magnesium structures. Chief among these are that magnesium is not ignited by incendiary bullets, and solid shot does not affect magnesium structures much differently from aluminum. The shot removes the metal in its path but does not propagate cracks or tears excessively. There is much less "tuliping" than with aluminum and the holes are less ragged. Explosive shells are more destructive to magnesium structures than to aluminum structures.

Credit for the success of the meeting is shared by the sponsoring groups, the Society of Automotive Engineers and its four Pacific Coast Sections, the Aeronautical Chamber of Commerce of America, the Air Transport Association of America, and the National Aircraft War Production Council, Inc.

Official representatives were: President Mac Short, of the SAE; John G. Lee, Aircraft Activity vice-president; S. K. Hoffman, Aircraft-Engine vice-president; John A. C. Warner, SAE secretary and general manager; C. L. Johnson, general chairman, National Aircraft Engineering and Production Meeting; J. H. Kindelberger, chairman, Aircraft Engineering Display Committee; O. E. Kirchner, Aircraft Activity, C. F. Bachle, Aircraft-Engine Activity, Wallace Linville, chairman, Southern California Section, Alfred G. Cattaneo, chairman, Northern California Section, Z. C. R. Hansen, chairman, Oregon Section, and W. E. Davenport, chairman, Northwest Section of the Society.

Exhibitors in the aircraft engineering displays were: Cleveland Pneumatic Tool Co., Pacific Metals Co. Ltd., distributors for International Nickel Co., Inc., Magnaflux Corp., Ryan Aeronautical Co., Bardwell & McAlister, Inc., Lord Mfg. Co., Wright Aeronautical Corp., Simmonds Aerocessories, Inc., Oakite Products, Inc., Kelite Products, Inc., Tinnerman Products, Inc., Rohm & Haas Co., Inc., Adel Precision Products Corp., Ducommun Metals & Supply Co., Tubing Seal-Cap, Inc., Interstate Aircraft & Engineering Corp., C-B Tool Co., Turco Products, Inc., American Bosch Corp., National Screw & Mfg. Co., Aeroquip Corp., Swedlow Aeroplastics Corp., Purolator Products, Inc., and the Society of Automotive Engineers.

SAE Job Praised . . .

EVERY SAE member will find reasons for justifiable pride in these excerpts from letters commendatory of SAE wartime engineering read at the SAE National Aircraft Engineering and Production Meeting in Los Angeles:

". . . the Army Air Forces are appreciative of SAE contributions to engineering which are so essential to continued volume production of superior warplanes and engines. Your Society has done outstanding work . . . Your Engineering and Production Meeting is tangible evidence of valuable war engineering services. . . ." – Gen. H. H. Arnold, USA, Commanding General, Army Air Forces.

" . . . ability to build, and to provide quick replacements for losses, to adjust to new needs and new designs, is the decisive factor in achieving speedy victory . . . Your design engineers rightly deserve the praise of a nation . . . For what you have done the Navy salutes you with a 'well done.' . . ." – Rear Admiral DeWitt C. Ramsey, USN, Chief, Bureau of Aeronautics.

" . . . gatherings such as this . . . can do much to strengthen the enviable position which this Nation holds in the engineering development and production of military aircraft. We feel that the interchange of technical experience to be derived from this meeting will greatly enhance the satisfactory conclusion of our primary job today – maximum production of superior combat aircraft . . ." – President James P. Murray, Aeronautical Chamber of Commerce of America.

Some Views of the Engineering Display

Technical IDEAS for ENGINEERS

Briefed from Papers given at SAE SECTION MEETINGS

Radical Ideas Lose In Symposium on Tomorrow's Automobiles

▪ Metropolitan, Oct. 7

NOBODY should expect radical departures from current automobile design trend in the immediate post-war era, seven outstanding automobile engineers agreed in a symposium presented before the Metropolitan Section Oct. 7.

Basing his presentation on the most exhaustive survey of engineering opinion ever assembled, Floyd F. Kishline, chief engineer of Nash Motors Division, led off the symposium by showing that although there is vigorous disagreement as to many component developments, engineers are generally agreed that motorists will have to wait some years before models approach the stylists' dreams. As to price, there was unanimity that because of increased taxes and probable increase of labor rates, post-war cars would cost more – not less – than their pre-war prototypes.

Two striking developments were cited by scores of engineers in their replies to the questionnaire sent to them by Chairman Harold F. Blanchard, technical editor of *MoTor*, and analyzed by Mr. Kishline. They were:

Supercharging of passenger car engines to improve efficiency, and

Sweeping improvements in torque converting. Great improvements in various devices have been accomplished during the war effort, engineers reported. and a number held high hopes for developing an effective, low-cost, constant-variable transmission.

Mr. Kishline said that answers to the questionnaire, which he highlighted in his presentation, did not indicate that any work is being done on passenger car design by these engineers, all of whom are devoting full time to the war effort.

His analysis of the answers indicated considerable agreement by engineers that 60 mph was sufficiently high for the top speed of smaller automobiles.

Few men expected radical shifts to light metals, although most agreed that secondary aluminum would be used extensively in the engine and for accessories. It would appear that the car of the immediate post-war era would be built largely of carbon steels.

Practically everyone who responded to the specific question about the future engine believed that some improvements are due. A small minority believed that wartime experiments with fuel injection would lead the way to the elimination of the carburetor. A smaller group believed that military experience with aircooled engines would blaze the trail for this type of powerplant in automobiles, but only a few of these men went into detail (see abstract of Carl Doman's paper).

Excerpts from the talk by D. G. Roos, vice-president in charge of engineering, Willys-Overland Motors, Inc., will be presented in the December issue of the *SAE Journal*. (Transcript of Mr. Roos' remarks was not available in time for incorporation in this issue.)

by ROY E. COLE
Studebaker Corp.

(Excerpts from paper entitled "Future Automobiles or Post-War Car," read by C. Louis Otto, Raymond Loewy.)

THERE is no question that the post-war car will be substantially the same vehicle that was being produced at the time the United States entered the war. As to the car that will be produced after a period of readjustment following the war, every engineer and designer has his own ideas as to what that ideal car should be.

There are certain fundamental points that must be kept in mind in developing a car of the future:

Economy of operation and weight reduction should not be too hard to accomplish, assuming that, in the post-war period, aluminum, plastics, new steels allowing for thinner gages, and so forth, will be available at a price which will permit their use.

Passenger comfort can be increased, without raising the cost of the vehicle, by: more headroom, without increasing overall height of the car; more comfortable seats, using various types of construction developed for airplanes and railway equipment; improving ventilating systems; installing smaller body pillars for better vision; allowing for easier egress and ingress by a door designed to open up into the roof of an automobile; better insulation against excessive heat; and better mechanical control, accomplished by improved automatic or semi-automatic clutches and transmissions.

Improved riding can be effected particularly by a completely new design. To date the engineer has been handicapped by following along year after year with minor improvements.

Door handles, bumpers, and radiator grilles should be functional and submerged in such a way as to become part of the entire automobile. The tendency to eliminate the running board, if handled properly, should entirely eliminate fenders and running boards, as such. The space they occupy could be used inside the car body, and the result would be improved appearance.

Almost every car on the road will be in sad need of repairs after the war. The accident and death toll will no doubt increase so much beyond anything experienced during wartime restrictions that drastic safety laws and regulations will be passed. This may well affect design of future automobiles.

All items going into the present car could be designed into the product as a whole, instead of tacking on an accessory here and there. They should also be so located and of such a construction that they can readily be inspected without requiring services of an expert.

by MAURICE OLLEY
British Ministry of Supply

(Excerpts from paper entitled "Notes on Light Motor Car.")

IT is impossible to improve entrance and exit of modern cars by studying size and shape of human beings.

For adequate stability, softness of a vehicle's suspension, measured by its "virtual staic spring deflection," must decrease in considerably greater proportion than the linear dimensions of the vehicle. Thus, if a vehicle of 136-in. wheel base is satisfactory as regards rolling on corners and brake dive, with a spring deflection of about 8 in., a small vehicle of 102-in. wheel base will be completely unstable with a static spring deflection of 6 in., and suspension will require stiffening up to a deflection between 3½ and 4 in. to obtain roadable stability.

It is highly desirable that a greater proportion of total occupied volume of the vehicle should be usable as passenger space. During the era of streamlining we have been talking functional design while achieving its antithesis. Thus the Army jeep, which contains some functional design, has been received with joy by the American public.

Although it is argued that almost any vehicle rides better as the load is increased, actually the ride has been improved because

the increasing load has increased the static spring deflection, and, as in the addition of luggage in a passenger car, it has also increased the moment of inertia of the sprung mass.

Saving weight demands a study of the possibilities of so-called "frameless construction." All closed passenger car construction is frameless to the extent that the ordinary closed car body contributes to the overall stiffness of the vehicle in greater proportion than the stiffest frame. The important function of the frame is to transfer the wheel loads to the body of the car in the best possible manner. Retaining rudiments of the frame to distribute the wheel loads to the car structure is preferred to purely frameless construction.

No considerable improvement in weight, cost, convenience, or efficient use of space and material can be expected by relocation of the powerplant. It belongs in front on a passenger car as definitely as it belongs at the rear in a bus.

Within the last seven years distribution of weight in a motor car has swung from being excessively tail-heavy at maximum load to being excessively front-end-heavy at light loads. This is due primarily to the large amount of "artistic" junk which has been hung on the nose of the vehicle by way of decoration. Removal of this will go far to restore balance to the vehicle in more ways than one.

by CARL T. DOMAN
Aircooled Motors Corp.

(Excerpts from paper entitled "Rear Engine Car.")

A PROPOSED rear-engine car has a wheelbase of 116 in., the same body space as a 1942 Ford, weighs a trifle more than 2000 lb and should run 30 mpg at 35 to 40 mph. Its engine is a 150 cubic six-cylinder of pancake design (that is, the cylinders are horizontal, arranged in two rows of three). Cylinders, pistons, crankcase, and transmission housing are aluminum. There is a conventional disc clutch and a three-speed transmission from whence power is transmitted by a diagonal shaft running down to drive the pinion and ring gear. The differential housing is integral with the rest of the powerplant since the rear wheels are independently sprung on transverse levers. The spring used is a torsional shaft connected to the top pair of levers. Luggage space is exceptionally large.

Air for cooling the engine is circulated by an exhaust ejection system instead of by a fan which would require 3 to 5 hp at 3500 rpm. Air enters the engine through scoops at the side and flows down through the spaces between the fins and into an air housing from whence air is discharged to the atmosphere by exhaust ejectors. Each set of three cylinders has its own exhaust manifold, muffler and a tandem ejector. Exhaust from the muffler is poured into the open end of the first ejector from whence it flows through the second and then out the tail pipe. Preliminary work on this type of cooling has indicated that it is possible to produce a pressure drop (1½ in. of water) across the cylinders that is more than adequate to circulate all the cooling air required.

We believe in a large bore, short-stroke

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• Higher Octane Gasoline Predicted for Post-War

by C. M. LARSON
Sinclair Refining Co.
▪ Baltimore, Oct. 14

(Excerpts from paper entitled "Post-War Fuels and Lubricants.")

THERE will be three grades of post-war automotive gasolines available.

The so-called house brand or regular grade gasoline will be 80 octane, such as now used by the Army (Motor Fuel All-Purpose U. S. Army Specification 2-103A). All ground vehicles, such as cars, jeeps, trucks, tanks, and so forth, using gasoline are designed for this 80 octane fuel and much is known as to the possibilities of engines designed for a post-war regular gasoline of 80 octane. The 1942 cars redesigned for 1946 with compression ratios increased by milling off a portion of the cylinder head and such minor changes made without too much loss in time, will use this 80 octane post-war regular gasoline. In some localities the knock rating will be 78/80 because some refiners have not been favored with modern equipment to make suitable base stocks and the maximum 3 cc tetraethyl lead restriction will not permit meeting U. S. Army Specification 2-103A. But this handicap will be soon overcome and in some instances is being met by cooperation of small refiners in the Middle West.

The premium grade gasoline will be 87 octane and in most cases will be 80 base stock leaded up to 87 so as to make Army-Navy Aircraft Fuel (AN-F-25). This premium 87 automotive-aircraft type of fuel would be available for private flying as well as post-war ground vehicles of high compression ratio design. Future premium gasolines built around 87 aviation grade would solve the distribution problem for the post-war automobile completely retooled with higher compression ratios, probably with fuel injection and supercharging, as well as for civilian flivver planes and helicopter bus and taxi service. Fuel economy of post-war cars in mileages of 25 to 50 mpg are needed to take advantage of these high-quality, higher-priced, high-compression ratio fuels. This high mileage will also be needed to overcome higher taxes, to double the life of available crude oil and to take care of lower wage standards.

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Money, Time Saved By Flight Tests

by JAMES B. KENDRICK
Vega Aircraft Corp.
▪ Northern California, Sept. 14

(Excerpts from paper entitled "Philosophy of Flight Testing.")

THE value of flight testing may be emphasized, in its true relationship to the engineering of a new design, by a brief consideration of the consequences if certain desirable tests are not accomplished or are delayed.

Weight: A series of flight tests for measuring stresses in many parts of the structure, requiring two to four weeks to perform, might permit a reduction in weight empty of 100 lb. Each pound of weight empty is worth $200, so for 1000 airplanes, a four-weeks test could be worth $20,000,000. However, such structural tests in flight are usually omitted because of lack of time.

Changes: It costs upwards to $20 per airplane to make a minor production change, such as redesign of a control system pulley bracket, after production has been established. A more extensive change, such as revision of the method of attachment of fabric to a control surface, may cost $180 per airplane. Redesign of fuel system may cost $3000 per airplane. Multiply these values by 1000 airplanes and drastic effects of making production changes are realized. However, nearly every new airplane design has its share of such changes, need for which is not fully recognized during early stages of flight testing.

Delay: The loss sustained by a manufacturer due to production delays is represented by the profit normally earned per airplane, times the number of planes affected by the delay. Such delays may sometimes occur due to present inability of the flight-test group to test every conceivable condition which may occur in flight in limited time available.

The most important purpose of flight testing is to protect the production schedule to insure that all parts of the airplane function satisfactorily, and thus eliminate delays and changes to production. The first phase may be called *proof* testing. General

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• Redesigned Airliners Meeting Needs of Army

by WILLIAM J. FORSTER
Curtiss-Wright Corp.
▪ St. Louis, Sept. 14

(Excerpts from paper entitled "Converting Today's Military Airplane Transports for Post-War Passenger and Cargo Use.")

THE majority of today's transport airplanes that are in active service for the allied armies all over the world are production models of pre-war luxury passenger transports, redesigned for cargo and troop transportation.

The Army model designation for a cargo airplane is a number preceded by the letter "C." The four airline passenger airplanes and their cargo counterparts are:

25,000-lb 21-passenger Douglas DC-3, converted to the 26,000-lb C-47 "Skytrain."

43,000-lb 36-passenger Curtiss Model 20, converted to the 45,000-lb C-46 "Commando."

50,000-lb 42-passenger Douglas DC-4, converted to the 52,000-lb C-54 "Skymaster."

73,000-lb 55-passenger Lockheed "Constellation," converted to the C-69.

These weights are design gross weights of the airplanes, and are generally greater than the commercial passenger transport weights. This is due to more efficient structural designing, which is generally possible when an airplane is redesigned.

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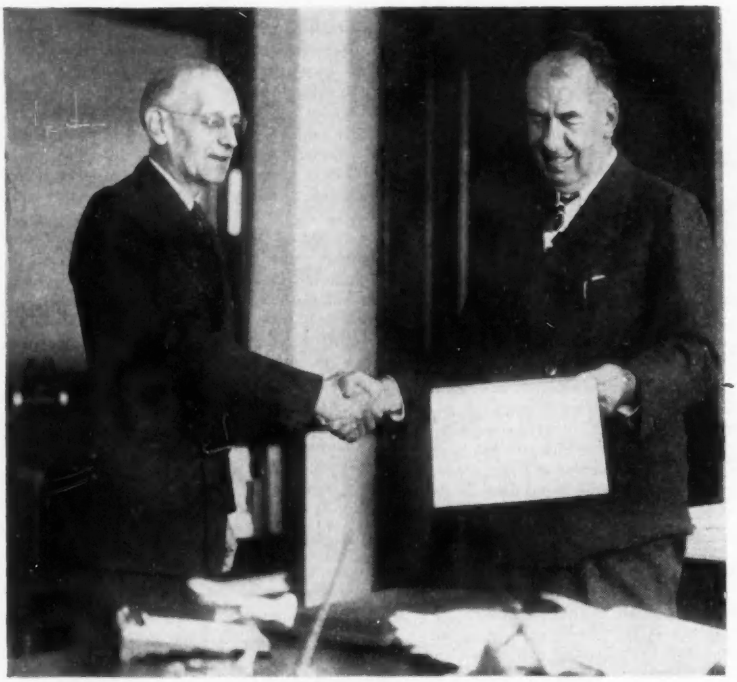
About



SAE Past-President Arthur W. Herrington, chairman of the board of Marmon-Herrington Co., Inc., who was awarded the honorary degree of Doctor of Engineering for his achievements in military transportation at the commencement exercises of Rose Polytechnic Institute, Terre Haute, Ind., recently, is shown being congratulated by George H. Freers, chief engineer at Marmon-Herrington Co. Speaking on "The Engineer's Part in Post-War Industry," Mr. Herrington said: "When the war is over, we will be living in a new world. It will be just as impossible to turn back on the results of all our accelerated research as it will be to turn back the inevitable passage of time"

JOHN F. CREAMER has returned to Wheels, Inc. as chairman of the board after spending more than a year as consultant to the U. S. Army. Mr. Creamer, who was a founder of Wheels, Inc. and was its president and general manager for more than 20 years, discussed developments in the wide base rim program at the second annual National Association of Independent Tire Dealers' conference Oct. 12 at the Hotel Commodore, New York City.

CAPT. DONALD B. ROBERTS was recently assigned to overseas duty. Capt. Roberts who graduated from the School of Military Government at Charlottesville, Va., is now attending Military Government School in North Africa, and may be reached at A.P.O. 512, c/o Postmaster, New York City.

LINWOOD F. MILLEN has left the General Fireproofing Co. of Youngstown, Ohio, where he was chief liaison engineer, to accept the position of B-29 engineering coordinator with Bell Aircraft Corp., Georgia Division, Marietta, Ga.

JOSEPH F. COURTNEY, is now president of West Town Auto Body, Chicago, Ill. He had been president of Underwriters Safety Device Co.

SAM TOUR, who had been vice-president in charge of chemical and metallurgical engineering, Lucius Pitkin, Inc., New York City, is president of Sam Tour & Co., Inc., of the same city.

F. W. BAJKOWSKI is now an ensign in the U. S. Navy. Ensign Bajkowski had been junior stress analyst, Lockheed Aircraft Corp., Burbank, Calif.

THOMAS L. FAWICK is now president of the Fawick Airflex Co., Inc., Cleveland, Ohio.

Formerly purchase contact engineer, Southern California Division, General Motors Corp., South Gate, Calif., **ROBERT M. BARNHART** is now project engineer for Aerojet Engineering Corp., Pasadena, Calif.

SAE Vice-President **S. K. HOFFMAN,** Lycoming Division's chief engineer, is back on the job again following a seven weeks' stretch in hospitals after his escape from death in a transport plane crash on July 28.

C. MORGAN RIFENBERGH has joined Westinghouse Electric & Mfg. Co., Lima, Ohio, as design and development engineer. He was formerly a physicist at Federal Telephone & Radio Corp., New York City.

WILLIAM ERNEST ENGLAND has left American Bantam Car Co., Butler, Pa., where he was factory manager, to become supervisor of inspection plants, Jack & Heintz, Inc., Bedford, Ohio.

Previously technical representative, Socony-Vacuum Oil Co., New York City, **GERALD FISHER** is now with General Petroleum Corp. of Calif., Los Angeles.

GEORGE B. LACY has been appointed a representative of the Bureau of Aeronautics, Navy Department, Washington. He had been a special representative of this Bureau at Army Air Forces, Midwestern Procurement District, Wichita, Kan.

T. F. BRACKETT, formerly chief methods engineer, Turret Division, Emerson Electric Mfg. Co., St. Louis, Mo., is now chief process engineer for Parker Appliance Co., Euclid, Ohio.

H. E. Simi

SAE Past Vice-President **H. E. SIMI,** formerly chief engineer and manager of plant 10, C. L. Gougler Machine Co., Kent, Ohio, is now an engineer for Timken-Detroit Axle Co., Detroit. Earlier, Mr. Simi was chief engineer, Twin Coach Co., for a number of years.

LT.-COL. W. H. FISHER, formerly director of the 27th Battalion Automotive School, U. S. Army, Eighth Infantry Regiment, Camp Croft, S. C., is now commanding officer of the 228th Battalion, A.G.F. Replacement and School Command, Camp Blanding, Fla.

COLUMBUS F. PONTI is a first lieutenant in the U. S. Army Air Forces, stationed at Moody Field, Valdosta, Ga. He had been automotive instructor at Queens Vocational High School, Long Island City, N. Y.

SAE Members . . .

Irving B. Babcock has been appointed vice-president of General Motors Corp. and general manager of the newly - formed Truck & Coach Division of General Motors, which is taking over the business formerly conducted by Yellow Truck & Coach Mfg. Co.

COM. **JOHN JAY IDE, USNR,** may be reached at U. S. Navy, 100, c/o Postmaster, New York City.

Formerly an instructor at the Denartment of Motor Transport, Field Artillery School, Fort Sill, Okla., **CAPT. JOHN H. SMETHERS** is now in the 310th Ordnance Maintenance Battalion, Camp Hood, Tex.

PVT. SAMUEL J. WAKSHULL has been transferred from Company B, 101st Engineer Combat Battalion, A.P.O. 26, Camp Gordon, Ga., to First Platoon Company B., A.S.T.V., Antioch College, Yellow Springs, Ohio.

CAPT. D. M. GOOGINS may now be reached at 184th Anti-Aircraft Artillery Gun Battalion, A.P.O. 649, c/o Postmaster, New York City. He had been in the 61st Coast Artillery.

C. N. Guerasimoff

C. N. GUERASIMOFF has been appointed chief engineer, Engine Division of the Buda Co., Harvey, Ill. Mr. Guerasimoff, formerly assistant chief engineer, has been with the company for the past nine years, during which time he has served as mathamatician, engineer on stress analysis, and design engineer on gasoline and diesel engines. From 1939 to 1940, he was in charge of the development and testing of diesel engines. In 1941 he was appointed assistant chief engineer in charge of the Radial Diesel Engine Division.

NEIL A. MOORE, Sealed Power Corp., Muskegon, and **HAROLD G. VAUGHAN,** Muskegon Piston Ring Co., Sparta, Mich., have been appointed members of the WPB Piston Ring Manufacturing Industry Advisory Committee, of which Norman B. Johnson, Automotive Division, is Government presiding officer.

R. R. PERRINO has resigned as principal instructor, Motor Training School, Quartermaster Replacement Training Center, Camp Lee, Va., to enlist in the Navy "Sea Bees." He may be reached at Battalion 135, Platoon 1, Company A, Camp Peary, Va.

LeROY F. MAURER has been transferred from the Buffalo, N. Y., to the Burlington, Vt., branch of Bell Aircraft Corp., where he is assistant manager in the Ordnance Division.

Formerly development engineer, Aircraft-Marine Products, Inc., Elizabeth, N. J., **WILLIAM S. WATTS** recently joined the Auto-Railer Division of Evans Products Co., Detroit, as chief engineer.

JAMES P. STEWART is now assistant general manager of McCulloch Engineering Co., Division of Borg-Warner Corp., Milwaukee, Wis. He had been manager of the Supercharging Department, Elliott Co., Jeannette, Pa.

RICHARD E. MOORE, formerly design engineer, Ordnance Division of Bell Aircraft Corp., Buffalo, N. Y., is now employed in the Metal Sales Division of Dow Chemical Co., Midland, Mich.

CURTIS L. MOODY has been named production manager of the Tire Division, U. S. Rubber Co., Detroit. He was previously factory manager of Dominion Rubber Co., Ltd., Kitchener, Ont., Canada.

L. B. RAGSDALE, formerly research engineer in charge of engineering on PT boat engines at Sterling Engine Co., Buffalo, N. Y., has recently joined Curtiss-Wright Corp. as manager of the Airplane Division Department in the newly-formed Development Division.

G. C. GRIDLEY, Mechanics Universal Joint Division, Borg-Warner Corp., and **T. V. BUCKWALTER,** vice-president, The Timken Roller Bearing Co., Canton, Ohio, were among the speakers at the 24th annual meeting of the American Welding Society held at the Morrison Hotel, Chicago, Oct. 18-21. The subject of Mr. Gridley's paper was "Machine Welded Metal Tubing," and Mr. Buckwalter's paper, coauthored by O. J. Horger, also of Timken, was on "Fatigue Strength of Welded Aircraft Joints."

GEORGE H. HUFFERD has joined the Weatherhead Co., Cleveland, as director of research. He had been development engineer, Houde Engineering Division, Houdaille-Hershey Corp., Buffalo, N. Y.

Previously head of the Service Division, Industrial Plans, Board of Economic Warfare, Washington, **GILES E. HOPKINS** is now research manager of the Textile Research Institute, Inc., New York City.

The first helicopter in this country to fly successfully – the Sikorsky VS-300 – was presented to the Edison Institute at Dear-

William B. Hurley, Detroit Edison Co., left, and E. M. Schultheis, Clark Equipment Co., have been appointed representatives of the Affiliate Council of the Engineering Society of Detroit

born, Mich., Oct. 7. The presentation was made by **IGOR I. SIKORSKY,** engineering manager of Sikorsky Aircraft Division of United Aircraft.

A. F. SCHAARDT, on leave from Hub Industries, Inc., Long Island City, N. Y., where he was methods engineer, is now serving in the U. S. Army Air Forces.

ROBERT L. SUTHERLAND, formerly connected with Buick Motor Division, General Motors Corp., Melrose Park, Ill., is now an engineer in the research department of Aeronca Aircraft Corp., Middletown, Ohio.

PAUL G. HYKES, a major in the Coast Artillery, is assigned to Headquarters 55th Anti-Aircraft Artillery Brigade and Combined Air Defense Training Center, Mitchel Field, L. I., N. Y., where he is plans and training officer.

Judges for the "6-16" model airplane contest held at the recreation center, Burbank Calif., Sept. 25-26, included SAE President **MAC SHORT, HALL L. HIBBARD,** vice-president in charge of engineering at Lockheed and Vega and **DUFF L. DEAN,** Lord Mfg. Co., all in the same city.

J. H. DAVIDSON is now a staff sergeant in the U. S. Army, 3115th Ordnance (B) A.V.M. Company, 615th Ordnance (B) A.M. Battalion, Camp Santa Anita, Arcadia, Calif. As a civilian he was field expediter for Timken-Detroit Axle Co., Detroit.

HENRY BJELLAND has been transferred from the U. S. Army Ordnance Automotive School, Fort Sheridan, Ill., where he was principal instructor, to Mount Rainier Ordnance Department, Tacoma, Wash.

D. PHILLIPS BAILEY, formerly automotive engineer, field work, Tide Water Associated Oil Co., Albany, N. Y., is a first lieutenant in the U. S. Army, Ordnance Department.

ERNEST O. WHEELER is an industrial art teacher at the Lyman School for Boys, Westboro, Mass. He had been state instructor of machine shop and related work, National Youth Administration, Salem, Mass.

Formerly connected with Lycoming Division, The Aviation Corp., Williamsport, Pa., **HANS RUTISHAUSER** has recently joined Aerojet Engineering Corp., Pasadena, Calif., as new development engineer.

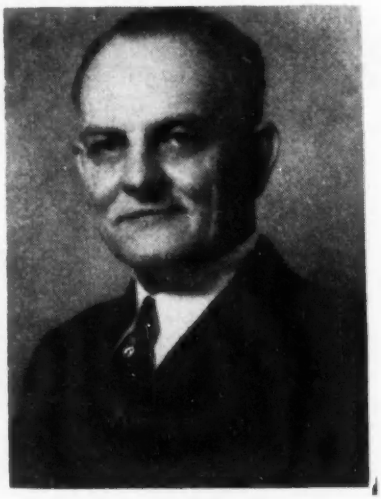
ENSIGN MORRIS G. AVERY, USNR, may be reached at B. O. Q. 67A, Room 266, N.A.T.C., Pensacola, Fla. Before entering the service Ensign Avery had been experimental test engineer, Continental Motors Corp., Detroit.

HAROLD F. HAMMOND, director, traffic and transportation division, National Conservation Bureau, has been elected president of the Institute of Traffic Engineers. He is also serving as consultant to the Army, Navy, and other branches of the Government in handling special traffic and transportation problems involving war plants and military establishments.

NORMAN G. SHIDLE, executive editor, *SAE Journal,* has been named chairman of the Public Relations Committee of the Automotive Safety Foundation, Washington, D. C.

HARRY H. PENCE, who had been principal automotive adviser, U. S. Army Plans & Training Branch, Automotive Section G-4, Chicago, is now with American Transportation Co., same city, as maintenance engineer.

The appointment of **E. F. LOWEKE** as hydraulic engineer of Hayes Industries, Inc., Jackson, Mich., has been announced by that company. He had previously been chief engineer of Hydraulic Brake Co., Detroit.



E. F. Loweke

Opening of a new engineering service office by Adel Precision Products Corp. in Seattle, Wash., has been announced by **H. RAY ELLINWOOD,** president. **JACK P. HORNING** will maintain contacts with line support accounts.

HARRY P. DOBROW, who is a member of the Engine Group on the staff of engineering specialists serving in the Ordnance Department, Tank-Automotive Center in Detroit, has been advanced to a higher position. Prior to his transfer to duty from the Office of the Chief of Ordnance in

Harry P. Dobrow

Washington to the Tank-Automotive Center, Mr. Dobrow was employed in the New Engine Development Department of Pratt & Whitney Aircraft, East Hartford, Conn.

A. W. F. GREEN has resigned as materials engineer, N. A. Woodworth Co., Ferndale, Mich., to join Pratt & Whitney Aircraft, Kansas City, Mo., in the same capacity.

ELBERT CLAYTON SMITH, lieutenant (jg), USNR, is in the Bureau of Aeronautics at the Naval Air Station, Quonset Point, R. I. He was formerly a director of engineering training in the U. S. Army Sacramento Air Depot, McClellan Field, Calif.

LAWRENCE B. JACKSON has resigned his position as manager of engineering at Fairbanks, Morse & Co., Beloit, Wis., to become director of engineering, Diesel Division of American Locomotive Co., New York City.

Representing the SAE as one of the judges in the monthly $100 war bond award for the best description of production short cuts, sponsored by *Aero Digest,* is **R. F. GAGG,** assistant general manager of Wright Aeronautical Corp., Paterson, N. J.

MAXWELL N. HALSEY, executive secretary, Michigan State Safety Commission, Lansing, Mich., and **DONALD D. BLANCHARD,** technical assistant to the general manager of the Society of Automotive Engineers, led panel discussions during a session on Post-War Traffic Safety Planning held as a part of the National Safety Congress in Chicago on Oct. 6. Mr. Halsey led the discussion on "Uniform Traffic Legislation," and Mr. Blanchard the discussion on "The Post-War Motor Car."

LT.-COL. WALTER C. THEE may now be reached at Ordnance Section, Headquarters, Seventh Corps, A.P.O. 307, c/o Postmaster, Jacksonville, Fla.

FAYETTE W. ESTILL, formerly tool planning engineer in charge of machine shop tools, Consolidated Vultee Aircraft Corp., Fort Worth, Tex., has become a partner of Estill & Howell Tool & Die Engineering Co., Fort Worth. He is also a tool engineer for the company.

WILLIAM R. CUBBINS, JR., who had been in the Tank and Motor Vehicle Bureau, Motor Vehicle Section of the Ordnance Department, U. S. Army, is now a director of field operations of Flight Training Research Association, Inc., Washington.

A. N. Morton

Appointment of **A. N. MORTON** as vice-president and director of Mack Mfg. Corp., Long Island City, N. Y., has recently been announced. He had been factory manager of International Plainfield Motor Co., Plainfield, N. J., but still retains his former position of production manager of Mack's factory holdings in Plainfield and New Brunswick, N. J.

Former manager of the Lubricants Department, Globe Oil & Refining Co., Wichita, Kan., **DAVID T. EVANS** is now connected with the War Department, U. S. Army Air Forces, same city, as assistant district supervising inspector.

CAPT. **CHARLES M. HANNUM** is a resident inspector for the Ordnance Department at Underwood Elliott Fisher Co., Hartford, Conn. He had previously been assigned to the Carbine Industry Integration Committee, New York City.

RALPH H. LEBOW has been commissioned an ensign in the U. S. Navy. He had been process engineer for Lawrance Engineering & Research Corp., Linden, N. J.

FREDERIC C. FEGLEY has joined Ranger Aircraft Engines, Division of Fairchild Engine & Airplane Corp., Farmingdale, L. I., N. Y., as supervisor of flight test.

Formerly acting project engineer, Kinner Motors, Inc., Glendale, Calif., **CHARLES E. MACDONALD** is now design engineer with the Vega Aircraft Corp., Burbank, Calif.

JOHN J. GILL is president of J. J. Gill & Associates, Trenton, N. J. Previously Mr. Gill was supervisor and tool engineer for Machine & Tool Designing Co., Inc., Philadelphia.

DONALD Y. NICHOLAS, who had been in the Production Planning Department of Breeze Corporations, Inc., Newark, N. J., is now an ensign, O-V(S), in the Bureau of Ordnance. Ensign Nicholas is stationed at Fort Schuyler, New York.

JOHN W. SHEA is a first lieutenant in the U. S. Army Air Forces, Materiel Command, Eastern Procurement District. He is assigned to the Bellanca Aircraft Corp., New Castle, Del.

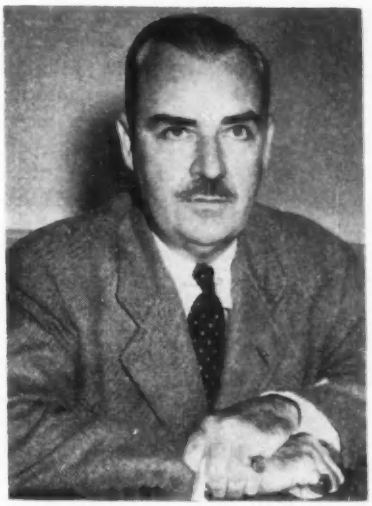
HOUSTON A. DAMRON, ensign, A-V(S), is now studying at M.I.T. to prepare for an assignment in naval aviation.

Lt. A. J. Raitch

Previously chief engineer, Bolens Products Co., Port Washington, Wis., **A. J. RAITCH** is now a lieutenant in the U. S. Navy.

CHARLES J. MURPHY, who had been plant safety engineer, Lawrance Engineering & Research Corp., Linden, N. J., has joined the Lithium Co. of Newark, N. J. as engineer.

The Titeflex Metal Hose Co. of Newark, N. J. recently announced the appointment of **ADRIEN T. von SCHMID** as special field representative to the aircraft industry. Mr. von Schmid, who joined the Titeflex organization in 1942, has had wide experience in the field of aviation, the major portion of which was gathered during the eight years he spent with the Wolf's Head Oil Refining Co.



Adrien T. von Schmid

CAPT. CHESTER O. FRENCH, JR., formerly project engineer, Equipment Laboratory, Experimental Engineering Section, U. S. Army Air Forces, Wright Field, Dayton, Ohio, has been named chief, Target Unit, Special Weapons Branch, at the same base.

ERNEST W. SEAHOLM has resigned from Cadillac Motor Car Division, Detroit, having been in that company's employ for over 28 years, 22 as chief engineer. He

Ernest W. Seaholm

expects to devote most of his time to consulting work relative to war production problems. Succeeding Mr. Seaholm is **JOHN F. GORDON,** who has been with the Cadillac organization for 18 years, most recently in supervisory capacities. Two years prior to assuming his new position, Mr. Gordon was loaned to Allison Division as chief engineer.

M. V. GATTER is now service manager and shop foreman for Auto Industries, Oakland, Calif. He had been automotive instructor, California State Board of Education, Fort Ord, Calif.

SAE Student Members who have entered military service recently include: **PRIVATE DAVID L. JONES,** Company A, 81st Training Battalion, 17th Regiment, Camp Roberts, Calif.; **ENSIGN WAYNE HAROLD BROWN, USNR,** in training at California Institute of Technology, Pasadena, Calif.; **HERBERT J. HOWERTH, JR.,** in the U. S. Army; **MARTIN S. ALLISON** is an aviation student in the U. S. Army Air Forces, Southeastern Army Air Force Command, Detroit Institute of Technology; **PHILIP C. ELLIS,** second lieutenant in the Army Air Forces, Army Air Base, Syracuse, N. Y.; **ENSIGN KINGSLEY C. ROCK, JR.,** U. S. Navy, training at Bowdoin College, Brunswick, Me.; **CHARLES L. SPRAKER,** private first class in the U. S. Army, now attending a course in mechanical engineering at Ohio State University; **ROBERT A. MORAN** is in the U. S. Army, Camp McCay, Wis.; **OWEN A. MOORE,** second lieutenant in the Corps of Engineers, Texas A & M. College Station, Tex.; **JACK SHELDON BLOUGH, USNR,** Midshipmen's School, Columbia University, New York; **FRANK WILLIAM BURGER,** now in the U. S. Army; **ENSIGN ROBERT JAY WAALKES, USNR,** Norfolk Navy Yard; **WILLIAM C. BUCK,** in the U. S. Army; **HARRY DEAN PAPE,** second lieutenant in the U. S. Army; **JOSEPH HUTFLES** is a private in the U. S. Army, Company C, 63rd Battalion, 13th Regiment, B.T.R.T.C., Camp Fannin, Tex.; **ENSIGN EDWARD L. CAIRNS, USNR,** c/o A & R Department, U. S. Naval Air Station, Navy 1955, Fleet Post Office, New York.

Among SAE members whose duties recently have been changed are: **OMAR W. SUTTLES,** Airfloat Coach Mfg. Co., Los Angeles, from vice-president to president and chief engineer; **RICHARD H. FISHER,** Wright Aeronautical Corp., Paterson, N. J., from engineering trainee to test engineer; **GEORGE E. FOGARTY,** Seneca Falls Machine Co., Seneca Falls, N. Y., from engineer to general sales manager; **ATHANAS PAUL FONTAINE,** Consolidated Vultee Aircraft Corp., Vultee Field, Calif., from chief engineer to assistant to the director of engineering; **WADE E. CANFIELD,** The S. K. Wellman Co., Cleveland, from division manager to assistant to the president; **ROGER HERMAN CASLER,** Automotive Air Brake Co., Division of Bendix-Westinghouse, Elyria, Ohio, from experimental engineer to manager of the Aircraft Division; **ROGER ROY CRESSWELL,** Donaldson Co., Inc., St. Paul, Minn., from planning engineer to production manager; **JOHN V. CHERASO,** The White Motor Co., Cleveland, from special development engineer to chief draftsman of the Truck Division; **DONALD A. VOORHIES,** Anchor Optical Corp., New York City, from head of the Tool Department to superintendent of the Metal Parts Division; **ROBERT J. DUNLAVEY,** Motion Picture Engineering Co., from designing engineer in the Detroit office to chief designer, with headquarters in Chicago; **ALAN F. KING,** Consolidated Vultee Aircraft Corp., San Diego, Calif., from director of the Economic Research Department to supervisor of the department; **FRANK A. PENCE,** Sun Oil Co., Detroit, from Northwestern representative (Minne-

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How Army Experience Will Serve Post-War Transportation

continued from page 19

tion before the war. These developments will be inherited in toto by the post-war world.

The unprecedented training program conducted by the Army Air Forces will have produced by the end of the year well over 2,000,000 men as trained pilots, navigators, radiomen, aircraft mechanics, airport engineers, traffic controllers, and the like. This pool will be available to post-war aviation.

The global nature of this war has necessitated the development of completely equipped airports along the principal airways throughout the world. Outside the United States this expansion movement has included the development of ports and even pipelines for the transportation of petroleum products. Within our country old airfields have been improved, new ones built, and innumerable auxiliary fields as well as "flight strips" have been conveniently located to provide overall facilities. In many instances routes have had to be completely charted whereas established routes have often been altered to conform to the Air Forces policy of fitting the route to the airplane. This policy is the opposite of that followed by the airlines before the war. Generally, the runways of airfields we are using have been lengthened and strengthened to make them suitable for big ships such as the C-54.

Communications have received particular attention and the advances in this field are noteworthy. Every facility for communications connected with over-water flights has been advanced and expanded since Pearl Harbor. Beams, with weather reports superimposed every half-hour, guide the pilots over land and water throughout the entire route in some cases. The crews of our ships no longer need search for a station that will give them their position. Even with one communications system out, his position and other necessary information can now be given to a pilot. A pilot may never see the ground from the time of his take-off at point of departure until he lets down through the clouds or fog over the airport at which he is to make his next landing; and yet, aided by the navigation facilities of the airways, he knows at all times exactly where he is. A number of airports in our country have been equipped with radio-instrument-landing installations and are serving as "laboratories" for this important development.

Many miles are flown by our planes over land and water with considerably less guidance. However, present-day instruments in the form of improved compasses and direction finders in the airplane capable of picking up radio signals over long distances are essential aids. Even today, however, transoceanic fliers frequently resort to celestial navigation for their guidance, a combination of two or more means of navigation being desirable from the standpoint of safety. Electronic instruments, and devices using electronic principles are reducing the chances of accidents in flight to a minimum. With the many developments in the field of electronics which the war will produce, and the progress in worldwide weather reporting, it can be reasonably assumed that the numbers of the air-minded public will be increased considerably.

As the result of collaboration with our allies, worldwide weather reporting has been effected. Weather stations have been set up at short distances apart along our main routes and at all outlying points from which disturbances or other phenomena which might affect weather along these routes could come. World weather conditions are reported and coordinated by the use of all known communications systems including radio teletype circuits. At island points radiosondes, small radio transmitters attached to balloons, are used to report pressure and humidity to

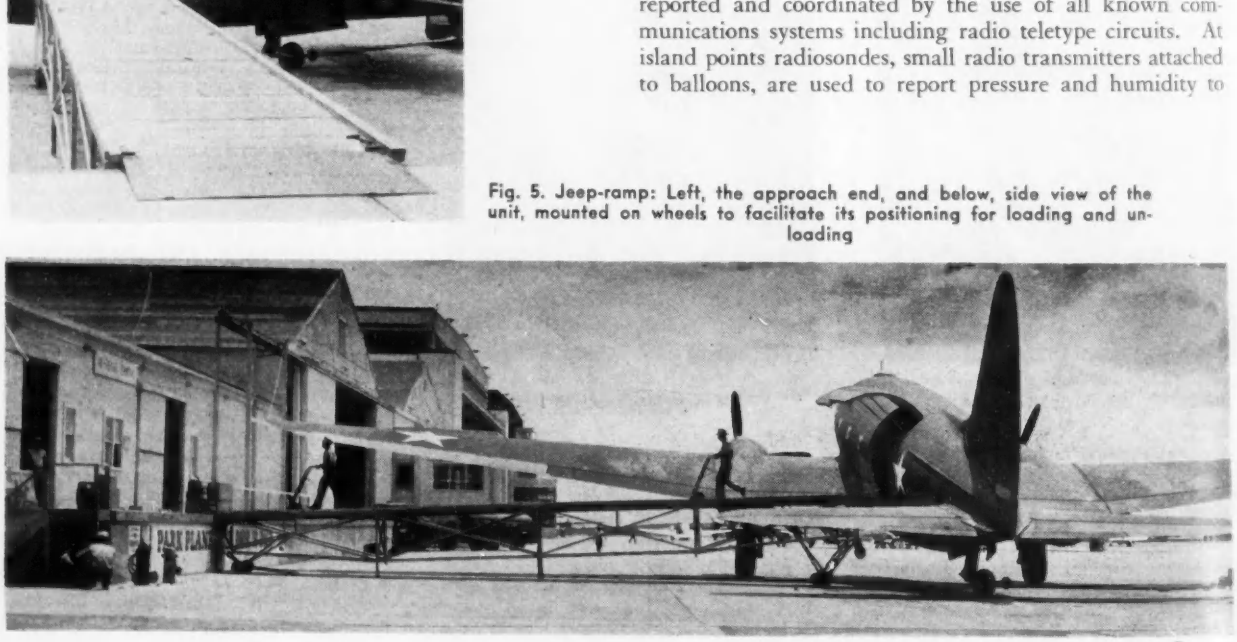


Fig. 5. Jeep-ramp: Left, the approach end, and below, side view of the unit, mounted on wheels to facilitate its positioning for loading and unloading

the ground station. As a pilot proceeds along his course he carefully checks the weather information contained in his flight forecast and reports any discrepancies for the benefit of successive flights.

Briefing, or giving the pilot and his crew all instructions and information necessary for a safe flight, is standard practice in the Army Air Forces although it was not used before the war by the commercial airlines. Likewise, strip maps have proved to be the best type of pilot's map; although these had not been generally accepted before the war. Still another pilot's aid consists of movies of approaches to landing fields and of the landing fields themselves from the air. These can be timed to coincide with the pilot's position so that he will have a preview of the terrain over which he will actually fly a short time later.

We are working out new techniques in traffic control. After the war we may expect problems of congestion of airplanes at certain points such as were unknown in 1941. We may take, for example, one of our island bases across which Army transports shuttle daily, and which is also a stopping point for ferrying movements which consist of anything from a single plane to several squadrons. A certain number of aircraft likewise operate locally for patrol and other purposes. There is no alternate base upon which an aircraft can let down, and many of them approach this island with a rather small reserve of fuel. The timing for bringing them in, the allotment of levels, has to be accurate and well considered. We have also points where considerations of weather and mountains create corridors. Movements of turbulence and cloud masses may cause these corridors to shift while aircraft are enroute, while over the higher parts of the terrain the corridor is shallow. At times, we are running as many as a hundred aircraft through these corridors in one day. There, we have congestion not only at the terminal fields, but along the line. In the future we may anticipate similar conditions between, for instance, Denver and Salt Lake City. In our operations we are continually developing methods of communication and control which will be extremely useful in the days to come.

The Army Air Forces have had to "brief" their personnel in sanitary measures and preventive medicines in order to keep them healthy in the many foreign countries through which operations are being carried on. Our experience should prove valuable to the medical world and post-war air travel on a worldwide scale. As regards the human body itself and the effect upon it of oxygen and pressurized cabins in high-altitude flying, there is a great deal of data being assembled. Unquestionably, much post-war long distance flying will be done in the stratosphere, and the results of wartime research will be useful. The Troop Carrier Command is charged with the evacuation by air of the sick and wounded from the Theaters. They have made possible a remarkable record of lower fatalities per casualty. The equipment, methods, and experience of the Command will benefit humanity in future catastrophes.

Two other types of aircraft, one an adaptation of an existing aircraft and the other an entirely new use of the rotary wing principle, have been developed by the Army Air Forces since Pearl Harbor. These are the glider and the helicopter. The Army Air Forces glider, an adaptation of the "sailplane," has been designed to carry personnel, equipment, and diverse cargo. For short hauls, reasonably efficient cargo-carrying operations can be performed by gliders with an appreciable payload increase.

Fig. 6. One of the 1200-lb portable turn-tables which is being experimented with by the Army for manipulating airplanes into position for loading and unloading

An interesting development is the pickup system now being used by the Army. By means of this, a loaded glider may be snatched from the ground by a plane which does not land. There is presently operating an air mail route on which mail is dropped in a small container and picked up in another container as the mail-plane swoops over the station. In this way, hundreds of communities, too small for regular air service, are provided with air mail facilities. The glider may be thought of as a larger container, with which the same operations could be performed on a larger scale, for carrying passengers or freight. Used in air transport, the pickup could eliminate the time wasted in landing, taxiing, unloading, and loading of the transport plane at intermediate stops. For complete realization of the commercial possibilities, however, special new cargo gliders must be designed as well as a special towplane for this operation, so that glider and tug are properly matched.

The helicopter represents a most interesting use of the rotary wing principle and its appearance has appealed to the imagination of the aeronautical engineer as well as the layman. That this aircraft has a great future is the firm belief of us in the Army Air Forces who are responsible for encouraging its development as well as ordering its production in substantial quantities. On the other hand all articles produced for some time to come are allocated to interested agencies (British, Navy, AAF, and so forth) for service tests. We shall know a lot more about the employment of the helicopter when these service tests have been completed. Meanwhile, wild speculations as to the revolutionizing effect this new aircraft will have and its varied uses in the post-war era are only misleading. In its present stage of development it is definitely limited to small cargoes, whether consisting of personnel or bombs. Basic engineering problems confront those who would increase its payload and, while not yet solved, experiments are tirelessly going forward. Without discussing the military value of the helicopter, it unquestionably represents an important aeronautical development of great versatility capable of employment in peacetime; privately, as a shuttle plane by airlines; for transporting light loads; and for rescue work.

The DC-3 had proved its airworthiness by the time we declared war. Employment and modification have made both the C-54 and the C-46 more thoroughly airworthy. The converted B-24 has proved successful as a conversion. Because of the necessity of maintaining an around-the-clock service and because of the varied conditions throughout the world in which Army Air Forces planes must operate, our planes have had to be developed into thoroughly airworthy, all-purpose planes. We have had to equip them

to operate in temperature conditions ranging from —61 F to +160 F. This means that a plane must be completely winterized to operate efficiently at the beginning of its mission, for example, and properly equipped to operate in tropical, desert, or special conditions before its mission is terminated. Complete winterization alone amounts to an extensive modification of the ship comprising or affecting hydraulic fluids, coolants, heating devices, landing gear, radio equipment and propellers.

In our efforts to reach maximum efficiency in the operation of our planes we have solved many pre-war questions of why planes fail in flight. We have made great strides in preventing and controlling fires occurring while our planes are airborne. Advances in fighting the elements, such as thunderstorms, are being made. We have increased the gross weight of all our cargo ships to the allowable maximum determined by stress loads, or strength factors of the airplane, and performance. We have been able to save 10% of the gasoline required under pre-war standards of operation. This has been accomplished by the development of a more efficient method of operating large aircraft over long distances. The old method was to cruise a transport plane at a fixed percentage of power, usually 50 to 60% of the maximum, because of schedule competition among airlines. Gasoline weighs 6 lb per gal, and the tonnage of gasoline conserved by more efficient operation represents millions of gallons. As the result of this conservation we have been able to load more cargo into our planes in the place of unneeded fuel. To illustrate, an airplane which would have required 2500 gal of gasoline for a certain flight under former conditions will now make the journey on 2250 gal. Three-quarters of a ton of cargo can be added in the place of the 10% saving in gasoline. This fuel saving has been accomplished through unceasing experiments with the assistance of the commercial airline operators and every manufacturer of transport airplanes in the United States. The average airplane is designed for maximum speed, namely: maximum number of miles per hour per horsepower. An airplane's maximum range is a compromise among three factors: maximum aerodynamic efficiency; maximum propeller efficiency; maximum engine efficiency. By varying the values of these three, one arrives at a point where the maximum number of miles per pound of fuel is achieved. This point represents the greatest load-lifting ability of the airplane for a given amount of fuel. Now this condition may be modified to obtain another maximum, namely: ton-miles per hour of cargo which can be carried between any two points with the least amount of equipment. In this way we attain the maximum cargo transporting ability of the airplane.

Since the war started the size of our cargo planes has increased. This development as far as we have carried it has resulted in greater economy in air transportation. Likewise the trend of our experimental cargo and personnel airplanes is toward increased sizes to provide increased payloads. All but one follow conventional design trends, and are powered by two or four engines. Gross weights range from 50,000 to 125,000 lb and passenger-carrying capacities from 40 to 90. Increased powerplant horsepower is being stressed as well as increased speed and range. The one unconventional type may prove to be the most efficient design for large planes of the future, for we already know that it can be built to weigh one-third less than a conventional design of comparable size. These experimental airplanes just discussed, it must be remembered, are military airplanes. Each one is designed for a specific mission which is governed by tactical requirements. Although a great advancement of the aeronautical sciences is certain to result from the experiences of the Army Air Forces during this war, it cannot be expected that the ideal passenger or cargo airplane will necessarily make its appearance. What should result, however, is a post-war legacy consisting of the total research and experience of the Army Air Forces during an unprecedented period of acceleration. It is up to the post-war period as to how this "golden book" is employed.

Aluminum Forging Technique Advanced

continued from page 24

finished heat-treated and artificially aged forgings than are found in the as-extruded material similarly heat-treated and aged.

Thus the final yield and tensile values in the finished 14 S-T forgings progressively decrease with increasing amount of forging until the amount of recrystallization is such that the mechanical properties approach those obtained on as-rolled heat-treated and aged stock.

Serving with Mr. Ziegler on this Subcommittee on Mechanical Problems, which has agreed to stand by to collect additional experience data, are:

H. D. Bitner, Reynolds Metals Co.;
M. E. Boyd, Willys-Overland Motors, Inc.;
Harvey Curtis, Dodge Aluminum Forge Division, Chrysler Corp.;
C. L. Foreman, Buick Motor Division, General Motors Corp.;
W. E. McCullough, Bohn Aluminum & Brass Corp;
C. F. Nagel and T. D. Stay, Aluminum Co. of America, and
H. F. Walker, Chevrolet Motor Division, General Motors Corp.

The fundamental part played by SAE in the war effort was described Sept. 27 in a coast-to-coast broadcast over the Mutual network as a part of the weekly Army Air Forces radio show. In the studio at KHJ, Los Angeles, l. to r.: JOHN A. C. WARNER, SAE secretary and general manager; La Verne Browne, engineering test pilot, Douglas Aircraft Co.; Lt. Tony Lumkin, Army Air Forces producer; and MAC SHORT, SAE president and vice-president in charge of engineering, Vega Aircraft Corp.

Coordinating Research Council Of SAE and API Reports Progress

Peacetime Effort of Fuels and Lubricants Group Multiplied Tenfold to Aid Winning the War

THE Coordinating Research Council of the SAE and American Petroleum Institute through its 150-odd working groups has multiplied its peacetime fuels and lubricants research activity tenfold to aid in winning the war, according to its annual report to its sponsors (Sept. 13, 1943).

Most of the projects reported on and under way have been undertaken at the request of the Army Ordnance Department, Army Air Forces, Corps of Engineers, the Navy, the War Production Board, and other Government agencies.

The War Advisory Committee of CRC receives requests for specific projects, and assigns them to one of these committees, which in turn makes the assignment to one or more working groups:

- Coordinating Fuel Research Committee;
- Coordinating Lubricants Research Committee, and
- Coordinating Equipment Research Committee.

In some projects more than one of the above committees are involved, and occasionally the SAE War Engineering Board or other SAE committee has a part in their development.

Research results which may serve in standardization are referred to the SAE General Standards Committee, the API, and the American Society for Testing Materials, or any other standardization body interested in the subject matter covered.

Under the Coordinating Lubricants Research Committee, more than a score of projects have been undertaken for the Army Ordnance Department, and 975 copies of Procedures for Engine Oil Qualification and 6850 copies of report forms, a total of 96,000 sheets, have been distributed.

Intensive work is under way on transmission and gear oil projects for the Ordnance Department, Signal Corps, and the Office of Defense Transportation. These research projects involve field work at various Army camps and Government laboratory work by scores of laboratories from coast to coast. Since the first of the year 12 meetings have been held on gear lubricants, and numerous progress reports have been submitted to the Government agencies interested and to refineries and equipment manufacturers cooperating in the work.

Many Laboratories Participate

For example, 15 laboratories are participating in the development of a satisfactory method for determining low-temperature characteristics of greases, and instructions for lubricating wheel bearings have been formulated and reported to the Ordnance Department.

In an attempt to simplify requirements of Government grease specifications, a complete summary and analysis of these has been reported to the Military Services at the request of the Army-Navy Aeronautical Board.

Six projects on hydraulic fluids for the Office of Defense Transportation, Ordnance Department and other Government agencies have been completed or are near completion.

Stemming from 22 years of cooperative research experience, five important laboratory knock rating projects have been focused upon immediate war emergency needs by the Coordinating Fuel Research Committee. This Committee is working also on nine engine detonation projects. Vapor lock tests for the Ordnance Department at Camp Seeley, for which a total of 26 expert refinery technicians have been loaned, promise important results. A 25-page report on the effect of fuel volatility on engine starting, involving tests on 12 tanks using five different fuels, has been rendered to the Ordnance Department.

Each month a panel has met to consider the stability requirements for engine fuels. Five panels were organized to handle the several phases of this problem, which include effects on fuels of various coatings of containers, anti-oxidant effects on storage life of fuels, and recommendations to the Ordnance Department and the Army Air Forces in respect to handling fuels in storage.

Pushing Fuels Research

Twelve projects on detonation of aviation fuels are being carried out under the

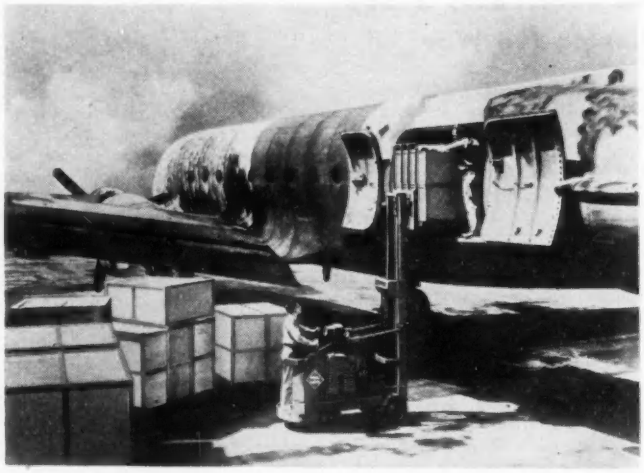
SAE-ODT Welding Group Meets at L.A.

SAE-ODT Committee on Welding in Maintenance met in Los Angeles to discuss their final report. Inset, Chairman E. C. WOOD, Pacific Gas & Electric Co. Seated, l. to r.: ROBERT N. REINHARD, Golden State Dairy Co. (guest); L. E. McKIBBEN, Lang Transportation Co.; ELLIS W. TEMPLIN, Los Angeles Bureau of Power and Light; E. F. LOWE, manager, West Coast Office, Society of Automotive Engineers; FRED C. PATTON, Los Angeles Motor Coach Co.; W. J. CUMMING, Office of Defense Transportation; LENNON DUNTLEY, Pacific Freight Lines; FRED GROHS, Victor Equipment Co.; W. R. SMITH, Lincoln Electric Co.; WALLACE E. POWELSON, Los Angeles County Fire Department; and W. WESLEY MILLS, W. W. Mills Laboratories. Standing, l. to r.: H. L. THOMPSON, Los Angeles Motor Coach Co.; JOE DILWORTH, Adel Precision Products Corp. (guest); and GUS A. MARTIN, Pacific Freight Lines

AIR CARGO MEETING

Knickerbocker Hotel, Chicago **Nov. 8-9**

S • A • E



MONDAY, NOV. 8

MORNING

Air Cargo Plane Design

E. P. Warner, Chairman

Some Economic Aspects of Commercial Use of Converted Military Aircraft
– E. C. Wells, Boeing Aircraft Co.

Design Considerations of the Cargo Airplane
– Carlos Wood, Douglas Aircraft Co., Inc.

AFTERNOON

Air Cargo Operations

J. A. Herlihy, Chairman

The Use of Air Freighters in Areas Not Served by Other Adequate Means of Transportation in Northern Canada
– W. L. Brintnell, Aircraft Repair, Ltd.

Payload Versus Operating Speeds – Air Cargo Transport Operations
– J. G. Borger, Pan American Airways System

EVENING

Air Cargo Handling Problems

Melvin Miller, Chairman

Basic Fundamentals for Packaging Air Cargo Shipments
– J. H. Macleod, Hinde & Dauch Paper Co.

Air Cargo Handling Equipment Design Consideration
– H. W. Anderson, Whiting Corp.

TUESDAY, NOV. 9

MORNING

Air Cargo Development Problems

Russell Forbes, Chairman

Coordinating Air and Surface Cargo Transportation
– J. H. Frederick, Air Cargo Editor, D & W, and Professor of Transportation, University of Texas

The Characteristics of Air Cargo Transportation
– E. J. Foley, American Airlines

The Characteristics of Surface Cargo Transportation
– Fred Carpi, Pennsylvania Railroad

AFTERNOON

Helicopter Operations

B. J. Vierling, Chairman

The Helicopter and Direct-Lift Craft
– W. B. Stout, Stout Research Laboratories

EVENING Banquet

Casey Jones, Toastmaster

The Potential Air Cargo Market
– Hon. Wm. A. M. Burden, Special Aviation Assistant to the Secretary of Commerce

Under Auspices of Chicago Section with Cooperation of National Aircraft Activity

Proposed Constitutional Change

AT the Business Session of the Society during the Annual Meeting scheduled for Detroit Jan. 10 to 14, 1944, the following proposed amendments to the Society's Constitution will be brought up for discussion in accordance with the requirements of the Constitution. The proposed amendments provide that paragraph C-1 of the Society's Constitution be amended to read: The title of this Society is "Society of Automotive and Aeronautical Engineers, Inc." and that paragraphs C-2, C-8, C-9, C-10, C-11 and C-52 be suitably amended, substituting the words "automotive and aeronautical" for the word "automotive" as it appears in each of these paragraphs.

These proposed amendments were last discussed at the 1943 Annual Meeting at which time they were tabled for further consideration at the 1944 meeting.

guidance of the CFR Aviation Fuels Division at the request of the Army Air Forces and Navy Bureau of Aeronautics. Revised methods of test for knock rating of aviation fuels have been completed, and 80,000 copies of two report forms were distributed during a single month. A program of training laboratory technicians to operate the CFR Supercharge Knock Test Engine has been inaugurated. Four regional meetings have been held by the Operation & Maintenance Group, the Reference Group, and the Waukesha Motor Co., builder of the equipment.

Intense study of vapor locking characteristics of aviation fuels is under way; this work is subdivided into six projects for maximum speed, and the National Bureau of Standards and the Navy Bureau of Aeronautics and Materiel Command, Army Air Forces, are cooperating closely to solve general and specific problems.

Four projects are progressing on volatility of aviation fuels, including a series of flight studies being made for the Army Air Forces by TWA with the cooperation of groups of the CFR Aviation Fuels Division.

Study of coolant liquids for airplane engines has been undertaken by this division. A major task consists of 15 potential coolant systems design projects divided into five groups. Other phases cover corrosion effects, engine testing, and the development of new coolants.

Eleven projects are being carried on in the field of diesel fuels, involving cold room and field tests for performance over a wide temperature range. This work is supervised by the CFR Automotive Diesel Fuels Division.

The Engine and Operation and Maintenance Divisions of the Coordinating Equipment Research Division report rapid progress on seven projects requested of the CRC by the Ordnance Department. Field work is being carried out with the cooperation of the Army, which has already received several progress reports on various phases of this work.

Aero Standards

Aero Parts Group Reports Progress

PROTECTION of aircraft engines will be speeded by two new standards developed by Committee E-5-A, Standard Parts, of the SAE Aircraft Engine Subdivision. The projects cover dimensional standards and require use of a black acetate material for propeller shaft end caps, to protect the threads of single and dual rotation engine shafts while being handled in the factory during assembly. The standards:

AS-42, for outboard shaft sizes 10, 20, 30, 40, 50, 60, 70 and 80, and

AS-170, inboard propeller shaft cap for sizes 60, 70 and 80 shafts. The inboard cap can be used for shafts in shipment, and a project is now under way with Committee E-9, Preservation of Engines, for a series of caps to protect outboard shaft ends to be used in connection with the latter committee's standard transparent envelope for enclosing the entire engine.

The engine industry has been anxious for such standards. Some of the companies have been using their own non-interchangeable caps.

These standards will conserve a large quantity of critical materials, including zinc and aluminum alloys heretofore generally used. Shaft end threads are ground to close tolerances, and the use of the caps avoids costly and time-consuming refinishing of damaged threads.

To eliminate scores of odd sizes of taper pins, the committee has also submitted a standard to the Aeronautics Division (AS-132) and a new standard for clevis pins (AS-133) has been developed.

Members of Committee E-5-A, which operates under the general supervision of Committee E-5 under Chairman P. S. Farnsworth, Pratt & Whitney Aircraft, are:

M. E. Mills, Wright Aeronautical Corp., chairman;

H. C. Beyer, Ranger Aircraft Engines;

W. W. Hayes, Jacobs Aircraft Engine Co.;

D. I. Jenkins, Lycoming Division;

J. P. Flannery, Aircooled Motors Corp., and

W. C. Oestrike, Allison Division.

Cooling System

Maintenance Manual By SAE Group Helps Improve Efficiency

COOLING systems of motor vehicles have been given a thorough going-over by the Subcommittee on Cooling Systems of the SAE-ODT Coordinating Committee in a report on approved maintenance methods made to the Office of Defense Transportation.

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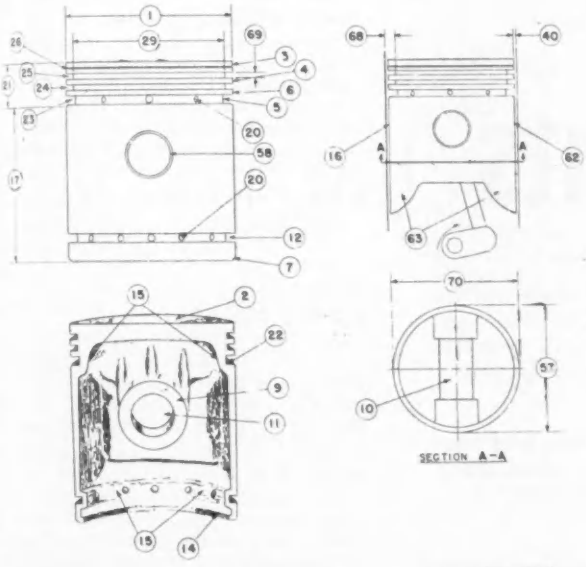
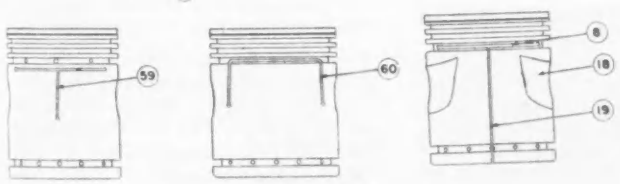
SAE Standardizing Piston and Ring Nomenclature

To end confusion of misnomers, the project standardizing piston and ring nomenclature has been circularized with the result that some constructive suggestions have been submitted to the committee. After final analysis of comments, the Gasoline Engine and Diesel Engine Divisions will submit a final recommendation to the SAE General Standards Committee for approval and publication in the 1944 "SAE Handbook." The project was suggested by Macy O. Teetor (*SAE Journal*, September, 1934) and a tentative list was submitted to the vehicle, engine, and accessory manufacturers of the industry.

PISTON NOMENCLATURE





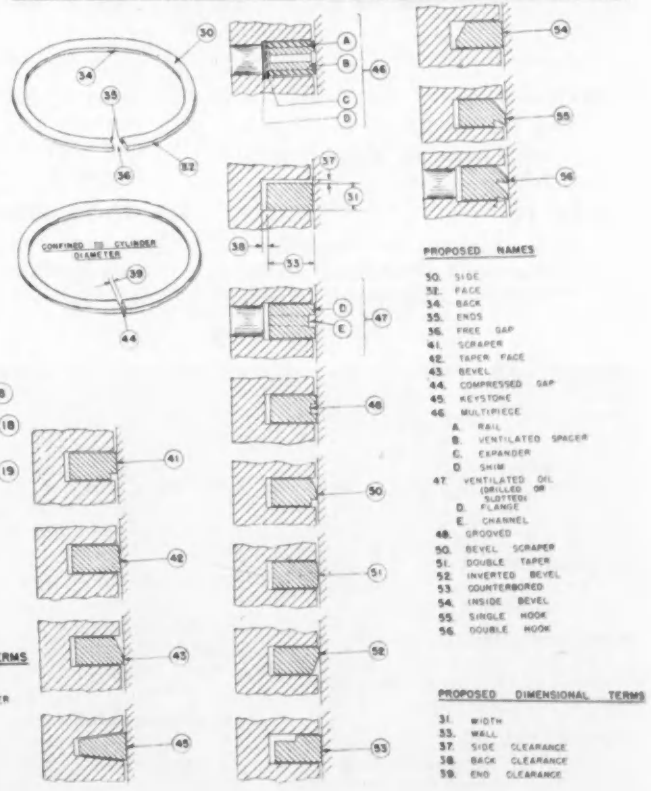
PROPOSED NAMES

2. HEAD
3. TOP LAND
4. 2ND LAND
5. RING GROOVE BOTTOM
6. 3RD LAND
7. CHAMFER
8. HORIZONTAL SLOT
9. PIN BOSS
10. PISTON PIN
11. PIN HOLE
12. SKIRT RING GROOVE
14. BOTTOM RIB
15. RING GROOVE PAD
16. MAJOR THRUST FACE
17. SKIRT
18. SKIRT RELIEF
19. VERTICAL SLOT
20. OIL DRAIN HOLES
21. RING BELT
22. RING GROOVE SIDE
23. OIL RING GROOVE
24. 2ND RING GROOVE
25. TOP RING GROOVE
26. HEAT DAM
58. PIN BUSHING
59. T-SLOT
60. U-SLOT
62. MINOR THRUST FACE
63. SLIPPERS

PROPOSED DIMENSIONAL TERMS

1. LAND DIAMETER
29. GROOVE BOTTOM DIAMETER
40. LAND CLEARANCE
57. MINOR DIAMETER
68. GROOVE DEPTH
69. GROOVE WIDTH
70. MAJOR DIAMETER

PISTON RING NOMENCLATURE



PROPOSED NAMES

30. SIDE
32. FACE
34. BACK
35. ENDS
36. FREE GAP
41. SCRAPER
42. TAPER FACE
43. BEVEL
44. COMPRESSED GAP
45. KEYSTONE
46. MULTIPIECE
A. RAIL
B. VENTILATED SPACER
C. EXPANDER
D. SHIM
47. VENTILATED OIL (DRILLED OR SLOTTED)
D. FLANGE
E. CHANNEL
48. GROOVED
50. BEVEL SCRAPER
51. DOUBLE TAPER
52. INVERTED BEVEL
53. COUNTERBORED
54. INSIDE BEVEL
55. SINGLE HOOK
56. DOUBLE HOOK

PROPOSED DIMENSIONAL TERMS

31. WIDTH
33. WALL
37. SIDE CLEARANCE
38. BACK CLEARANCE
39. END CLEARANCE

Rambling Through Section Reports

HIGHLIGHTING ST. LOUIS SECTION meeting in September was exhibition of many types of fuses, shells, bombs, tools, and other ordnance equipment made available by Section Treasurer A. F. Stoehr and U. S. Ordnance Department friends . . . A slow-motion picture of combustion and knocking in gasoline engine cylinder was provided by the National Advisory Committee for Aeronautics, and was shown with comments by G. C. Hazard, Socony-Vacuum Oil Co., Inc. . .

Popularity of movies also evidenced by presentation at Sept. 28 KANSAS CITY SECTION meeting of "Battle of Britain," showing actual scenes of aerial combat between RAF and the Luftwaffe . . .

Over 500 members and guests were present at September CLEVELAND SECTION meeting to hear former Flying Tiger Kenneth Jernstedt's talk and see the film "Report from the Aleutians" . . . Dinner was ready for 367 people, but 75 were turned away . . .

Major H. R. Higgins has been named vice-chairman of WASHINGTON SECTION . . . While E. Roger Burley heads T&M, Truck, Bus and Railcar Activity of CHICAGO SECTION . . .

An added feature of NORTHWEST SECTION meetings, which is devoted to solving automotive and technical problems, is the Technical Committee . . .

Declaring that the much-praised Gen. Erwin Rommel, Nazi commander, had never won a battle against well-trained troops and was far from the "master mind" that is painted by the press, Major-Gen. A. H. Gatehouse told the DETROIT SECTION, in his discussion of modern tank warfare, that he had the highest praise for the American tanks, particularly because of their endurance under field conditions where maintenance is impossible much of the time. He had once seen the American M-3 in one major campaign for 38 days, covering 2700 miles and keeping on the move almost continuously.

SAE Coming Events

Nov. 4-5
SAE National Fuels and Lubricants Meeting, Mayo Hotel – Tulsa

Nov. 10
SAE Meeting on Materials – War and Post-War, Hotel Carter – Cleveland. Sponsored by SAE Truck and Bus Activity and SAE Passenger-Car Activity with cooperation of Cleveland Section

Jan. 10-14, 1943
SAE Annual Meeting and Engineering Display, Book-Cadillac Hotel – Detroit

■

Baltimore – Nov. 11
Engineers Club; dinner 6:30 p.m. Speaker – O. Marin, Ramsey Accessories Corp.

Canadian – Nov. 17
Royal York Hotel, Toronto, Ont. Aviation Gasoline – George H. Freyermuth, technologist, Standard Oil Co. of N. J.

Chicago – Nov. 8-9
Air Cargo meeting. With cooperation of National Aircraft Activity.

Cleveland – Nov. 1
Cleveland Club; dinner 6:30 p.m. Winterizing – R. L. Weider, experimental engineer, White Motor Co.

Detroit – Nov. 15
Horace H. Rackham Educational Memorial Bldg.; dinner 6:30 p.m. Speaker – Major-Gen. Charles E. Branshaw. Subject to be announced.

Indiana – Nov. 12
Gold Room, Antlers Hotel, Indianapolis; dinner 6:45 p.m. This Business of Airplanes – Mac Short, vice-president, Engineering, Vega Aircraft Corp., and president, SAE. Guest – John A. C. Warner, secretary and general manager, SAE.

Kansas City – Nov. 5
Continental Hotel; dinner 6:30 p.m. This Business of Airplanes – Mac Short, vice-president, Engineering, Vega Aircraft Corp., and president, SAE. Guest – John A. C. Warner, secretary and general manager, SAE.

Metropolitan – Nov. 4 and Dec. 2
Nov. 4 – Georgian Room, Pennsylvania Hotel, meeting 8:00 p.m. Some Tactical Considerations in Aircraft Design – Brig.-Gen. Franklin O. Carroll.

Dec. 2 – Pennsylvania Hotel, meeting 8:00 p.m. High Octane Fuels. Speakers – Bruce K. Brown, Assistant Deputy Petroleum Administrator for War, will review the production record of 100-octane and its probable effect on future fuels. Charles A. Chayne, chief engineer, Buick Motor Division, General Motors Corp., will review the significance of these new fuels in terms of existing and future engines and vehicles.

Milwaukee – Nov. 5
Milwaukee Athletic Club; dinner 6:30 p.m. Subject and speaker to be announced.

Mohawk-Hudson Group – Dec. 7
Inspection trip to Marshall-Eclipse Division, Bendix Aviation Corp., Troy, N. Y.

New England – Nov. 16
Engineers Club, Boston; dinner 6:30 p.m. Perpetuation of American Transportation System – E. N. Hatch, sales engineer (buses), American Brakeblok Division, American Brake Shoe & Foundry Co.

Northern California – Nov. 9
Hotel Leamington, Oakland. Subject and speaker to be announced.

Philadelphia – Nov. 10
Engineers Club; dinner 6:30 p.m. Winterization. Speakers – R. L. Weider, experimental engineer, White Motor Co.; Adolph Gelpke, chief engineer, Autocar Co.; G. Ralph Strohl, special equipment engineer, Autocar Co.

Southern California – Nov. 12
Hollywood-Roosevelt Hotel, Los Angeles; dinner 7:00 p.m. Win with Wings – Miss Carol Flanagan, Douglas Aircraft Co., Inc. Duties and Responsibilities of a Civilian Automotive Adviser to the Army Ordnance Department – John B. Clark, Civilian Automotive Adviser.

Southern New England – Nov. 3
Hotel Bond, Hartford, Conn.; dinner 6:30 p.m. Future Aircraft Trends – William B. Stout, Stout Research Laboratories of Consolidated Aircraft Corp.

Southern Ohio – Nov. 10
Van Cleve Hotel, Dayton; dinner 6:00 p.m. This Business of Airplanes – Mac Short, vice-president, Engineering, Vega Aircraft Corp., and president SAE. Guest – John A. C. Warner, secretary and general manager, SAE.

Texas – Nov. 2
Baker Hotel, Dallas; meeting 8:00 p.m. This Business of Airplanes – Mac Short, vice-president, Engineering, Vega Aircraft Corp., and president, SAE. Guest – John A. C. Warner, secretary and general manager, SAE.

Twin City Group – Nov. 4
Curtis Hotel, Minneapolis; dinner 6:30 p.m. Some Views of Modern Bearing Technology – Carl E. Swartz, Cleveland Graphite Bronze Co.

Washington – Nov. 8
Mayflower Hotel, Washington, D. C.; dinner 7:00 p.m. See to Fight Rather Than Fight to See – Dr. George B. Watkins, Libbey-Owens-Ford Glass Co. Movie – Plane Facts about Glass.

Wichita – Nov. 3
Allis Hotel, Wichita, Kansas; dinner 6:30 p.m. The History of the Development of Aircraft Wheels, Brakes, and Shock Struts – J. R. Cautley, Bendix Products Division, Bendix Aviation Corp.

SECTION ROUND-UP

Baltimore . . . Clifford M. Larson, Sinclair Refining Co., discussed "Post-War Gasoline and Lubricants" at the Oct. 14 meeting.

Chicago . . . Speaker at the T&M Meeting Oct. 12 at the Knickerbocker Hotel was Lt.-Col. Harry O. Mathews, Ordnance Department, Tank-Automotive Center, Detroit, who stressed the latest advance in Army practice of transportation and maintenance of trucks and motor vehicles.

Charles Lipson, Engineering Division of Chrysler Corp., spoke at the Oct. 19 meeting in South Bend on "Methods of Stress Determination."

Cleveland . . . Speaking on "Electronics in Industry" at the Oct. 4 meeting, Carl J. Madsen, Westinghouse Electric & Mfg. Co., emphasized the special application of electronics to the automotive and aircraft industry. His talk was supplemented by a 20-min animated sound film entitled "Electronics at Work."

Detroit . . . Major-Gen. A. H. Gatehouse of the British Army, who spent three years fighting Rommel in the Libyan desert area, and commanded an armored brigade in the Nazi general's defeat at El Alamein, told a story of modern tank warfare as evolved from his own experiences before this Section at the Rackham Memorial Building on Sept. 27. Gen. Gatehouse appealed for help in developing protection for tanks against mine fields which defend the fortresses of Europe, and said that the land mine is one of the important hazards of the coming offensive in Europe. A mechanical means of making mines ineffective must be found to replace the primitive methods which expose troops to enemy fire while sappers or engineers clear the ground by probing for hidden explosives, he insisted.

Indiana . . . Resumé of results of a test program carried on to explore possibilities of the split engine was subject of a paper "Fuel Economy and the Split Engine" by Emil O. Wirth and Albert H. Winkler, chief and research engineers at Bendix Aviation Corp., presented at the Hotel Antlers, Indianapolis, Oct. 14, by Mr. Winkler.

Kansas City . . . Capt. Dixie Kiefer, Naval Air Primary Training Command, Fairfax Naval Air Base, Kansas City, outlined personal experiences in his talk "The Yorktown in Action," which was given at the Continental Hotel, Sept. 28.

Metropolitan . . . "Cars of the Future" was the subject of the Oct. 7 meeting. Attendance was so large that the meeting had to be transferred from the Georgian Room to the Roof of the Hotel Pennsylvania. Digests of these reports appear in this issue of the *SAE Journal* beginning on p. 28.

Milwaukee . . . Coffee Speaker M. B. Crew, Perfex Corp., discussed fuel conservation as a means of forestalling rationing in his talk on "Combustion Control" at the Oct. 1 meeting. Speaker of the evening was F. W. Grant, Norton Co., whose discourse on grinding wheels was illustrated by two films showing the manufacture of grinding wheels and the use of wheels on various machines and objects.

Northern California . . . One of the highlights of James B. Kendrick's paper, "The Philosophy of Flight Testing," delivered at the Sept. 14 meeting, was: Hundreds of man-hours are required to analyze the results of flight tests conducted by present methods. Digest of this paper appears in this issue of the *SAE Journal* beginning on p. 29.

Southern California . . . SAE Past-President William B. Stout, designer of the Sky Car and Scarab Automobile, discussed "Research and Post-War" at an after-dinner meeting sponsored by the SAE Aircraft Activity at the San Diego Hotel, San Diego, Oct. 5.

Southern Ohio . . . Dr. Reid G. Fordyce, research chemist of Central Research Division, Monsanto Chemical Co., spoke on "Plastics – The Materials of the Future," at the Hotel Van Cleve, Dayton, Oct. 11. Dr. Fordyce, who has specialized in high polymer research, presented many applications and possibilities for his materials.

Texas . . . Mac Short was principal speaker at the Nov. 2 meeting at the Baker Hotel, Dallas. Announcement of other nationally prominent speakers who have been scheduled for future meetings was made by Chairman Harold Schwedes.

Washington . . . Arthur B. Van Buskirk, deputy administrator in charge of operations, Lend-Lease Administration, spoke informally at the Mayflower Hotel on Oct.

SAE Men at Cold-Operations Equipment Inspection

American and British Army officers inspecting the cold-operations equipment installed on Army vehicles at a preview at the State Fair Grounds, Detroit, Sept. 15. Extreme left are Roy E. Cole, sponsor of the SAE War Engineering Board's cold-operations project, and W. S. James, chairman of the Cold-Operations Committee

Below: Part of the group of civilian engineers, including members of the SAE-W.E.B. Cold-Starting Committee, who inspected equipment developed by the Tank-Automotive Center of the Army Ordnance Department. Some of the units were based upon recommendations of the SAE-W.E.B. committee

SAE Meeting

MATERIALS . . .

War and Post-War

Nov. 10, Hotel Carter, Cleveland

10:00 Truck and Bus

E. M. Schultheis, Chairman

Characteristics of Plastics as Engineering Materials
– W. F. Bartoe and Dr. D. S. Frederick, Rohm & Haas Co., Inc.
In connection with this paper several plastics manufacturers have arranged a display of their products.

2:00 Passenger Car

Roy Cole, Chairman

Effect of Wartime Fuel Development on Post-War Passenger Cars
– A. T. Colwell, Thompson Products, Inc.

Recent Progress in Synthetic Rubbers
– P. M. Torrance, The Firestone Tire & Rubber Co.

6:30 Social Half-Hour

7:15 Dinner

Cleveland Section – Hosts
Harry F. Gray, Chairman
Robert Cass, Toastmaster
"After the War – What?"
Willard T. Chevalier
Publisher of Business Week, Vice-President and Director, McGraw-Hill Publishing Co.

11. His assistant, H. C. L. Miller, joined him later in discussions of the Lend-Lease program.

Twin-City . . . R. A. Daily, battery engineer, Delco-Remy Division, General Motors Corp., spoke before the dinner meeting on "Storage Battery Performance at Low Temperature" at the Curtis Hotel, Minneapolis, Oct. 7.

Muskegon . . . The history, development and grades of NE Steels were discussed in a paper "Substitute Steels or Some Practical Applications of National Emergency Steels," given by T. M. Snyder, Continental Motors Corp., at the Oct. 7 meeting in the Convention Room of the Occidental Hotel.

Cooling System Maintenance Manual

continued from page 39

The committee of 12 maintenance engineers and chemists under the chairmanship of D. H. Green, National Carbon Co., Inc., set up for the first time a comprehensive manual showing operators how to prolong the life of radiators, water pumps, and other cooling system elements, and to maintain engine efficiency.

In general, the report discloses, maintaining the water in a radiator at the proper level will prevent costly repairs.

Engine overheating due to loss of cooling liquid should be prevented by inspection and servicing leakages and overflow losses rather than by adding water or valuable antifreeze continually.

Importance of the cooling system is emphasized by the statement that the cooling liquid and radiator dissipate enough heat to keep a six-room house warm on a zero day, and at high speed the pumped water would fill a 50-gal drum in 60 sec.

Suggestions Illustrated

Several practical suggestions for gaging water level in radiators are illustrated, and details of preventive inspection are offered to improve the efficiency of the engine and to conserve parts. One section discusses in detail the physical characteristics of antifreeze, and warns against the use of specific types of solutions.

The report which was published by the Government Printing Office, is available from local ODT Vehicle Maintenance Offices.

Members of Subcommittee

Members of the subcommittee, of which W. A. Taussig, Burlington Transportation Co., was project chairman included:

D. H. Green, National Carbon Co., chairman;

F. R. Archibald, National Carbon Co., Inc.;

Joseph Askin, Fedders Mfg. Co., Inc.;

J. D. Bradley, American Ice Co.;

Edward Chadwick, Little Falls Laundry Co.;

H. C. Duus, E. I. du Pont de Nemours & Co.;

L. R. Gwyn, Jr., Railway Express Agency, Inc.;

E. N. Hatch, American Brake Shoe Division, American Brake Shoe & Foundry Co.;

W. R. Herfurth, R. H. Macy & Co.;

J. J. McCarron, Consolidated Telegraph & Electrical Subway Co.;

C. E. Smith, Burlington Transportation Co.;

H. M. Smith, Connecticut Railway & Light Co.; and

G. E. Stewart, United Parcel Service of N. Y., Inc.

Parts Protection

Aero Engine Equipment Assured of Safe Keeping

PROTECTION of hundreds of millions of dollars worth of finely finished aircraft engine parts is better assured by specifications for a laminated greaseproof wrapping paper, developed by Committee E-9, under the chairmanship of A. P. Ayers, Pratt & Whitney Aircraft. This is one of a large number of detailed specifications developed by this committee (see "Battle of Corrosion Won," p. 49, *SAE Journal*, August, 1943).

Careful study of the chemistry and physical characteristics of paper was undertaken by Committee Member M. H. Young, Wright Aeronautical Corp., and his associates. Methods of chemical and physical tests are outlined in the specification, AMS-3542.

Among the requirements of the paper are:

Hydrogen ion concentration, pH	6.5 – 7.5
Chloride plus sulphate	0.1% maximum
Water repellency, hr	24 minimum
Greaseproofness, min	30 minimum
Aging, hr	70 minimum

Tearing resistance, tensile strength and stretch machine limits in two directions are outlined.

Members of Mr. Ayers' committee, besides Mr. Young, are:

R. D. Goodall, Davison Chemical Corp.;
B. L. Sharon, Lycoming Division;
R. L. Heath, Allison Division, and
H. A. Lockwood, Chandler Evans Corp.

SAE National

FUELS & LUBRICANTS

Meeting

Nov. 4-5

Mayo Hotel, Tulsa

APPLICATIONS Received

The applications for membership received between Sept. 10, 1943, and Oct. 10, 1943, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Carl Gorman, Paul J. Siebert.

Buffalo Section: Dennis Hsueh-Hsi Liu.

Canadian Section: A. G. Holmes, C. H. Mulveney, William John Ross Paton.

Chicago Section: William E. Boris, Jr., Leroy B. Bornhauser, Edwin L. Fisher, James L. Haynes, Keith B. Hocker, Howard Jarmy, Milton P. Klintworth, John P. Kuyper, Leon M. Laskowski, Franklin McCuaig, Robert A. Noland, Edward Henry Rollfs, Charles A. Siler, Harry B. Stone.

Cleveland Section: John W. Bandusky, George W. Becker, William A. Benser, Edward Arthur Brittenham, Jr., Paul D. Brodie. Joseph J. Brown, Rinaldo Brun, Burnell O. Burritt, Richard J. Cerny, Wallace A. Christianson, Robert W. Daykin, Richard M. Downing, Thomas A. Freestone, Donald C. Guentert, James A. Hilgendorf, George Hoffmann, Merle C. Huppert, William C. Jenkins, Ray L. Johnson, Samuel Kassouf, Joseph E. Kruse, Alvin Louis Ledel, Ernest B. Mansfield, Thomas R. Neuburger, Edward G. Pekarek, Carl Joseph Pennig, Elgin Lawrence Shaw, Richard Sibley Shetter, Earle C. Smith, James C. Sweger, William M. Wilks, Carlton L. Zink.

Detroit Section: George Eugene Adams, David I. Babitch, Edward A. Bachle, Arthur Franklin Baske, Victor H. Bernardi, Frank C. Burrell, James H. Clark, Jr., William John Clark, George Frank Cram, William M. Dawe, Morgan Willis Dawley, Robert Thomas Doughty, William E. Drinkard, Francis S. Driscoll, Carl O. Durbin, Ronald F. Dusenbery, Elton M. Eldredge, Charles E. Ervin, Jr., Christian T. Feddersen, Frank L. Fisher, Charles H. Frick, Robert W. Gaines, Laurence W. Gauthier, Robert R. Hanson, R. H. Hensleigh, H. Hintzen, John Allan Holt, W. A. Hunter, Thomas L. Jackson, John H. Jurasek, Theodore C. Kuhlman, Roy George LaGrant, Lawrence John Lavalley, Stanley L. Lundsten, Harold J. McCotter, Thomas J. Marshall, Thomas L. McCarthy, J. L. McCloud, Robert W. Miner, James W. Morse, Paul M. Nash, Henry J. Paulsen, W. Harold Peet, John V. Peters, William G. Reid, Walter N. Scharff, Oscar L. Sokol, Jr., Edward W. Stoehr, Augustine J. Syrovy, Joe H. Talley, Ambrose E. Trubey, John Joseph Uicker, Joseph N. Ulman, Jr., William G. Voigt, Harold G. Warner, Wilfred Lewis Was, B. Donald Zannoth, Maurice M. Zuckerstein.

Indiana Section: William E. Barnes, Justin Blay, Maurice Bookout, William S. Castle, Earl B. Dickison, Lorraine J. D. Frazer, Wallace Lumpkin.

Kansas City Section: Whitney M. Kerr.

Metropolitan Section: Capt. Horace Levering Arnold, William H. Bacon, Jr., William E. Bates, John A. Bugge, Courtney F. Dolan, Robert Dunn, Andrew G. Farkas, Cameron Douglas Flanigen, Jr., Charles L. Fleming, Jr., Sebastian Flores, George R. Forman, Halton H. Friend, Reynolds M. Garrett, Philip V. Haddad, W. Leroy Hall, Harry Haykin, Buford W. Hulfish, Dean W. Johnston, John A. Kimberley, Lt. (jg) Benjamin J. Lehman, Sigmund Lisbon, Stanley H. MacArthur, John Markell, Jr., Charles Hart Miller, John B. Richey, John Drake Rogers, Frank C. Russ, Edward Vincent Schussler, James A. Scott, Jr., K. E. Sutton, Carl O. Tongberg, Philip F. Weber, Harvey W. Welsh, Theodore J. Zeller.

Milwaukee Section: Robert C. Kleinow, Howard N. Sill, Rene J. Steckel, R. H. Wolff.

New England Section: Thomas F. Gallagher, Earl N. Hatch, Paul V. O'Connell, George D. Rosekelly, Arthur W. Wanzer.

Northern California Section: Edward J. Hock, Lt.-Com. Arthur Clyde Jenkins, Donald Kay Kirkbride, Joe Lyon, Jr., Ensign Hugh Rainey Melrose, Edward H. Santos.

Northwest Section: M. G. Barlow, Earl P. Bartholomew, John F. Conner, J. M. Farnsworth, Paul H. Grimm, Charles Kendsur, Robert Lester Scott, Kenneth W. Self, Raymond O. Snodgrass, Walter T. Thorsen.

Peoria Group: Eugene L. Helton, Robert Eugene Kennemer, Roger M. Smith, Chester Wallace Thompson.

Philadelphia Section: Richard A. Booker, Jr., William T. Clark, William H. Curtiss, John S. Killaly, Robert W. Lindberg, Harry A. Schneider, Jr., Frank W. Wellons.

Pittsburgh Section: Ensign Leroy Martin Beckett, Ray Mansmann, James H. McCrady, III, Westinghouse Electric & Mfg. Co.

St. Louis Section: Luis Bazuerizo, Harry H. Bidwell, William H. Bruce, Jr., J. B. Codlin, William Wallace Cornman, Douglas W. Erskine, Norman H. Foss, William C. Geiser, Robert Irving Goldberg, Sylvester E. Hogan, Bernard J. Murphy, Robert Davis Philbrick, Arthur Dale Preston, David Rinkema, Frederick A. Schick, Michael Toth, Stuart E. Vance.

Southern California Section: Rufus H. Barrett, Charles S. Batterson, Paul K. Beemer, Edwin J. Burnell, Reginald Burrows, Major Arthur F. DeLong, Craig H. Edwards, William Eugene Elder, Ernest Erwin, George E. Fetterman, Thomas Francis Fitzgibbon, John M. Hoch, L. W. Hollingsworth, Milo C. Ketchum, Walter H. Korff, Alvin L. Johnson, Henry I. Mandolf, Thomas C. Still, Earl A. Stout, Herbert Francis Sturdy, Kenneth James Walker, Walter Charles Walling, Philip Richard Wong.

Southern New England Section: William B. Allison, Carlton William Boller, Leland D. Cobb, Arthur J. Guertin, Max E. Holcomb, William S. Horgan, Everett H. Kandarian, C. A. Lind, Clifford L. Martinez, Robert Washburn McClellan, Harvey D. Messer, George Willard Munson, Walter R. Wykoff.

Southern Ohio Section: Robert A. Cole, Ted W. Cozine, George Curtis Crom, Warren John Hartmann, Eldon R. Raney, James H. Tarkington, Harry Aubrey Toulmin, Jr., Herbert A. Wise, Jr.

Texas Section: T. E. Braniff, John Harding, Jr., Andrew Walter DeShong, George Gordon Langston, Jr., Lawrence Robert Schwedes, Raymond Carroll Schrader, William Bayne Summers.

Twin City Group: S. Harold Beach, Richard E. Dahlstrom, Robert E. Larson, Robert J. Lunn, Samuel H. McIver, Harvey Merritt Turner, Charles David Walter.

Washington Section: Lt.-Com. Abel Abeck, Paul Joseph Boeger, E. K. Burgess, Gordon Camden, James Gunn Goodwillie, II, John P. Manning.

Wichita Section: Lt. J. S. Brody.

Outside of Section Territory: Joseph Enos Aflague, Charles William Behrens, Milo M. Bolstad, Christopher Ainsworth Davis, John Russell Hahne, John Hardman, D. A. Lawless, Angus H. McGregor, George E. Miller, Capt. Harry A. Phillips, Alfred Leonard Read, William Fox Scarberry, Murray Weiss, Charles Barnett Wonders.

Foreign: Lt. (R.E.) John Sheppard Cumming (England). Leslie Geary (England). George MacLeod Ross (England). Lt. A. Eric Skelton (England). Zala Cromer Tatton (New Zealand).

NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between Sept. 10, 1943, and Oct. 10, 1943.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section: Charles O. Maguire (A), John Taaffe (A).

Buffalo Section: Burdette S. Wright (M).

Canadian Section: Frank Martin Booth (M), F. Arthur Kuhn (A), Gordon Blake Lang (A), H. S. Shannon (M), Q. C. Woods (A).

Chicago Section: Frank X. Coghlan (A), Francis R. Cross (J), Wendell P. Spurgin (J), Otto E. Wagenknecht (M).

Cleveland Section: Carroll Sherman Eian (J), Quentin N. Groth (J), Parry Keller (M), Robert M. Kintz (J), J. Arnold McCoy (J), Thomas F. Shaffer (A), Chester I. Smitko (M), Rollin Henry Spelman, Jr. (M), Raymond M. Standahar (J), George Suki (J), Joseph John Takacs (J).

Colorado Club: Oscar Robert Haueter (M).

Detroit Section: James H. Barnes (A), H. Y. Bassett (M), George W. Beltz (M), George D. Bogoliubov (A), Alexander Carlin (M), Noble Clark (M), F. W. Corwin (A), Richard F. Eberline (A), Clarke H. Field (A), Robert F. Flood (M), Philip I. Fobert (A), George I. Goodwin [illegible], Martin Hebert, Jr. (J), Edward H. Hewson (M), W. G. Howe (A), Frederick L. Hunter (J), Edgar M. Johnson (M), Philip G. Johnson (M), Theodore A. Kreuser (M), William Robert Palmer (J), M. Dwight Pearce, Jr. (A), John J. Petrik (M), Forrest V. Rhodes (M), Walter G. Robbins (M), William W. Sanford (A), S. Gordon Saunders (M), Norman A. Schassberger (M), Robert E. Schieber (A), Charles Earl Sexauer (A), Earle A. Tomes (A), Capt. Irvin Trowbridge, Jr. (J), Edgar Frederick Wait (M), Clifton Adelbert Warner (A), Lloyd J. Wolf (J).

Indiana Section: W. S. Bradfield (J), Albert E. Burch (A), Orville Charles Cromer (M), William W. Loman (J), Vincent Shannon (J), Charles Willard Van Overbeke (J).

Kansas City Section: William Erwin Briece (A), Jack Frye (M).

Metropolitan Section: Harold Barkan (J), Walter W. Burrows (J), John W. Collins, Jr. (J), Earl B. French (J), John McLean Hildt, Jr. (A), Morris Katcher (M), Lawrence D. Landrine, Jr. (A), Henry Wai Foon Lee (J), Samuel K. Lehman (M), Philip R. Marvin (M), Lt. Robert E. Molloy (A), C. Milton Rice (J), Harry Morefield Smith (J), John Paul Thomas (J), Lawrence F. Wilkens (J).

Milwaukee Section: Allen Bartlett (M), Arthur G. Bitzer, Jr. (J), Forrest Eugene MacDonald (A), Oscar H. Theleen (A).

Mohawk-Hudson Group: Clifford E. Bowdish (A).

New England Section: Christian T. Leander (A), James F. Wanless (A).

Northern California Section: Clifford Dale (A), Robert O. Kinsey (J), Walter Macdonald (A), George W. Quinn, Jr. (A), Lawrence J. Souther (M), Standard Oil Co. of Calif. (Aff.) Reps: Frank C. Bell., Herman J. Bihler, Wendell A. Hubbell, Jack B. Shayler, C. E. Vaughn.

Northwest Section: George A. Hundsdorfer (A).

Oregon Section: Walter G. Auer (A), Charles Henry Lewis (A).

Philadelphia Section: Louis F. Ehring (A), Cirino Giampapa (J), James E. Higgins (A), Murrell Dobbins Vocational School (Aff.) Rep: Harold S. Bostwick. Leslie B. Schramm (J), Carl A. Wahlquist (A), Richard H. Williams (A).

St. Louis Section: Henry A. English (A), Charles Warren Neff (J).

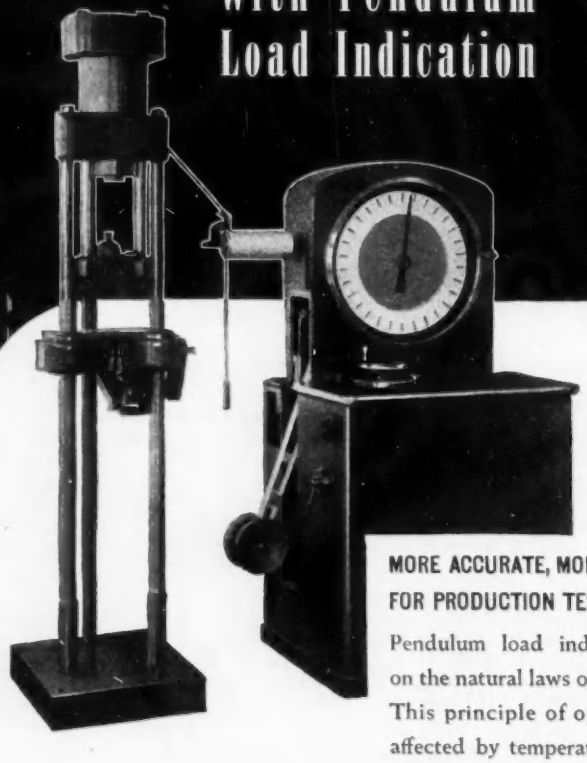
Southern California Section: Alvin Webster Baer, Jr. (J), Shirley Edson Brush (A), Timothy E. Colvin (M), Milo M. Dean (M), Robert Chalmers Gross (A), Charles W. Perelle (M), Parker Keith Remkus (M), Ralph B. Ullom (A), George Winston Wallace (A).

Southern New England Section: Walter Earl Brown (M), Henry O. Wuelfing (M).

Southern Ohio Section: J. R. Bengochea (J).

Syracuse Section: Louis L. Otto (M), Edwin B. Watson (J).

PRECISION
HYDRAULIC TESTING MACHINE
with Pendulum
Load Indication



MORE ACCURATE, MORE DEPENDABLE FOR PRODUCTION TESTING BECAUSE:

Pendulum load indicator operates on the natural laws of gravitation.... This principle of operation is not affected by temperature changes or subject to metal fatigue. . . . *Write for descriptive literature and quotations.*

ARMY E NAVY

RIEHLE
TESTING MACHINES
Division of
American Machine and Metals, Inc., East Moline, Illinois

Other Products: IMPACT TESTERS · VICKERS HARDNESS MACHINES
BRINNELL HARDNESS TESTERS · MEASURING INSTRUMENTS

Texo Section: Roy T. Holmes (A), Richard Ostlund (M).

Twin City Group: John Calvin Miller (J), Emerson Richard L. Nelson (J), D. E. Yates (A).

Washington Section: Lt. Col. John H. Frye (S M), John Ernest Ziccarello (A).

Wichita Section: Charles M. Jamieson (M), John S. Lawrence (A).

Outside Section Territory: Harold W. Anderson (J), J. G. Dorward (A), 2nd Lt. Jack I. DuBoff (J), Louis John Fleishman (M), Pierce E. Garlent (M), Alfred E. Grater (M), Everard L. Hemingway (M), Walter C. Jamouneau (M), Richard Bullock Lewis (J), Orville P. Martin (A), Joseph F. Meade (M), Robert A. Schorr (J), Fred J. Villforth, Jr. (J), Herbert Lee Wharton (S M).

Foreign: Lt. Col. W. H. Binns (F M), (England), Stewart Kevern Hambling (F M), (England), 2nd Lt. Arthur Leon Richards (F M), (England).

Radical Ideas Lose In Symposium on

Tomorrow's Automobiles

continued from page 29

engine. The short stroke cuts down overall engine width and the large bore permits exceptionally large intake valves which we enlarge still further by reducing exhaust valve diameter below the usual figure.

Looking ahead for some years following the close of the war, we are confident that engine speeds will climb higher and higher and that engines will become smaller and smaller, and lighter, so that peak rotational speeds of 6000 to 7000 rpm will not be unusual.

The same principles of design which apply to a flat engine could also be applied to an in-line or "V" type of engine. The flat engine, however, would seem to work into a rear-engine automobile much better than the vertical or "V" type. Furthermore, the flat engine can be made successfully with 4, 6, 8, or 12 cylinders or for a low-priced car, very successfully in a 2-cyl type.

When located in the rear it is a very simple task to direct air into the cooling fan from underneath the car, without worrying about the location of the radiator, hose, etc. In fact, due to the engine's inherent light weight, it could be mounted on the rear axle without interfering with the roadability of the car. The White Horse truck had the engine located in the rear and was bolted directly to the axle and pivoted on a rubber ball. The riding characteristics were surprisingly good; in fact, some of our recent automobiles do not give as good a ride as the White Horse truck.

Summing up the case of the aircooled powerplant for an automobile, it can be said that the engine could be built to incorporate all the advantages of the water-cooled type with none of its disadvantages and produced in quantities at no increased cost over the

"WHAT?... 30 Horsepower from THAT?"

"Yep, and full working pressure in 5 minutes!

"....What's more, that little Clayton flash type boiler will furnish all steam for heating, cooking, sterilizing, and all the hot water on our new ship.

"....The Navy uses them because they take less than ⅓ the space....and weigh only 25% as much as conventional marine boilers.

"....They're fully automatic, too....adjust themselves instantly to any load from full capacity to heating only a few gallons of water....and we don't have to watch them....they're always on the job."

Our sailor friend knew—could tell his new buddy not only from his Navy experience but because the cannery where he worked before the war had replaced a conventional steam boiler with a Clayton.

Now, Clayton flash type steam generators are serving on 15 different types of Naval Vessels—fighting on the seven seas. Sizes range from 15 to 100 Horsepower—all are capable of operating pressures of 10 to 150 pounds.

Other Clayton products serving the Armed Forces are Kerrick Kleaners....Kerrick Cleaning Kompounds.... Clayton Hydraulic Dynamometers....Clayton Boring Bar Holders....and Clayton Hydraulic Liquid Control Valves. Each is a specialized product—developed through endless pursuit of new ways, new materials, new principles to accomplish their jobs faster, cheaper and better.

CLAYTON

Manufacturing Company

ALHAMBRA, CALIFORNIA

water-cooled type. The service costs would certainly be less, due to the elimination of all existing cooling difficulties. We do hope that the automobile industry, when it again takes up the problem of selecting an engine for post-war cars, will seriously consider the aircooled type.

by ROSCOE C. HOFFMAN
Borg Warner Corp.

CERTAIN automobile manufacturers will find that they are unable to get into post-war manufacture of civilian products immediately after the cessation of hostilities because of continuing war contracts, whereas others may be able to get their prospective 1941 or 1942 models into production rather quickly. However, the public may expect that the immediate post-war models will closely resemble the latest pre-war models.

In view of the probability that post-war taxation will be high, it seems to me that the car of the future will be smaller and considerably lighter than pre-war models after the industry has swung from the pre-war economic considerations which did not put much premium upon low operating costs.

In general these cars will be as roomy as their pre-war prototypes. By functional designing, any of the "big three" could be reduced in weight to from 1900 to 2200 lb and still have as much roominess. There has been a national mental attitude which demands a big package – it is the yen to keep up with the Joneses. The post-war cost of fuel, lubricants, and tires may make some difference in this point of view. But history shows clearly that a new model of a car is sold as are women's hats – partly as an innovation and partly as a utility. The innovation features permit the owner to brag, and the price they pay for that privilege is sometimes rather high.

The way to design an automobile is:

Determine the size of the seating compartment, with depths and heights of cushions, head room, leg room, and other space factors carefully computed;

Estimate the frame and body weight, and

Design an engine to pull this weight.

Windows and doors must be functional if the vehicle is to be a success.

Let the stylist finish the remaining 10%

A rear-engine automobile, in my opinion, is fundamentally sound, and can be designed with excellent proportions and with good road visibility, rear visibility, ease of getting in and out, flat floors, and the vehicle low to the ground.

Too much of the pre-war car was designed by stylists, with the result a sharp trend away from functionalism. The engineering departments of car companies have been forced to leave too much to stylists with the result that radiator grills and bumpers loom like motifs stolen from circus wagons, for example.

Windshield wipers should be independent of the engine vacuum, and heating and defrosting equipment should be built into the car. Such design would take care of engine fumes by providing adequate ventilation in all normal operating temperatures.

The present type of engine appears to be the cheapest to build, but I believe there is a future for the barrel type, single sleeve, and possibly the two-cycle. It would take only a few cents to improve current ignition systems.

The future for automatic transmission is wide open. Within a few years after the war major companies will be offering automatic devices for cars in the $600-odd bracket. Supercharging also has a bright future.

I expect to see a trend toward lighter unsprung weight in automobiles and at a small additional cost.

Materials will still be chiefly carbon steels in automobile manufacture, although more alloys and light metals will be used both in functional and decorative, or adornment, parts.

Describes the Jeep

THE jeep has won a new place in the economy of the nation, and has already established itself as a peacetime vehicle, according to D. G. Roos, vice-president in charge of engineering at Willys-Overland Motors, Inc., who was again called upon by Mr. Blanchard to tell the audience his opinion of the vehicle's post-war potentialities.

"It is a mechanized mule that performs practically every function of anything on wheels. Its possibilities are being recognized by leading industries, and have been put to use by many of them. Its value after the

"S.A.E." is a symbol of service to the nation. Its members are more than technical experts . . . they are the prophets, the visionaries, the constructors, of a transportation system which has contributed more than its share in making America the richest, most comfortable nation of the world. And that service is not only helping to win the war but is looking ahead to the peace.

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FAY M. THOMAS GENERAL MANAGER

war will increase still further when the design will be de-militarized and the cost, as a result will decrease—without reducing its effectiveness in any way," Mr. Roos declared.

Other than for military purposes, the jeep has been used most extensively to date in agriculture, and with successful results. "On Government experimental farms, for example," he explained, "it has been found that it can pull two 12-in. plows in any kind of land and two 14-in. plows in soft terrain much faster than an ordinary tractor, and on 20 to 25% less gasoline. It can harrow and under some circumstances can be used to cultivate. It is a source of power, with a conventional take-off, to do farm work, and thus could accomplish a combination of agricultural duties.

The jeep is adaptable because of its four-wheel drive, and thus can go almost anywhere. Mr. Roos gave its dimensions as follows: 80-in. wheel base; 49-in. tread; road weight about 2300 lb; the maximum torque is 105 ft-lb at 2000 rpm; its hp is 61, and its top speed is 68 mph. Its low low is 25 to 1.

The speaker emphasized, however, that the jeep is not limited to farm use, but has potentialities in other fields as well. It can take the form of a little truck which has the power to pull a 1½-ton trailer behind it, or a passenger car to serve for a family shopping or outing. It can be used as a wrecking car for garages, as a lawnmower, or, as some logging camps have suggested, a vehicle for logging purposes. Another civilian function about which one farm has inquired, Mr. Roos said, is that of attaching the jeep in front of a snow plow. This is now being employed, successfully, by the Army. It has proved its worth also as a fire-fighter in the forestry patrol.

"The jeep unquestionably has a future," Mr. Roos concluded, "but it may acquire a sentimental value after the war that will keep the public from commercializing it, or considering it in any other than a military light."

Several railroad companies have written indicating their interest in the jeep as a maintenance of way vehicle.

Higher Octane Gasoline Predicted for Post-War

continued from page 29

The use of iso-octane as a blending agent for gasoline to compete with tetraethyl lead is very remote as lead will be made available at much lower figures than equivalent octanes with iso-octane or even alkylate.

Post-war fuels will not be rated by the ASTM Motor Method. Instead a road method for motor fuel knock ratings should be used for service performance. Octanes will give way to performance numbers as now used by the Army Air Force (AN-VV-F-748a).

The third-grade gasoline will be raised to 70-72 octane, mostly unleaded, available for the 15,000,000 pre-war cars still on the road and for such low-compression type of equipment until these units are worn out. This so-called "third structure" fuel eventually will pass out of the picture.

It is hoped that during the "hold the line" period of one to two years the public will not be confused by extravagant claims of advertising and sales promotion departments in connection with "super" automobiles, whereas it will actually be the pre-war car with simple modifications.

Diesel fuels (U. S. Army 2-102B) will be available but in many geographical areas the distillates, diesel fuels and kerosene are used for charging stock to make 100 octane gasoline. High cetane diesel fuels have a definite performance value for high-speed diesel engines. Kerosene probably offers the most uniform product, and this grade is well suited to high speed buses and truck service.

Money, Time Saved By Flight Tests

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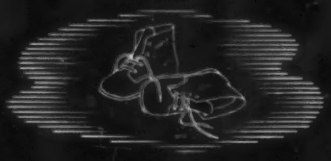
information is desired rather than extreme accuracy. Next phase is *accelerated service* testing, which should be started as early as possible. Judgment must be exercised to



How Will Your Children Live?

That's easy! They'll live better than you just as certainly as you live better than your parents. American industry has put the car, the refrigerator, the radio and other conveniences within the reach of all. After the war, the three-plant facilities of the Weatherhead Company will be prepared to help you build these products again and—mark this!—many strange new devices which one day will make your life, and your children's lives, far safer and pleasanter in scores of ways.

Look Ahead with Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO
Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
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avoid delays to the test program for correcting inconsequential defects. Failure to meet the last letter of the specification may involve a slight penalty, but this may be preferable to any delay in production, or to neglect of other important tests. Then attention may be given to *improvement* testing, which involves more accurate measurement of various functions, and scientific analysis leading to better efficiency. Numerous improvements may be made which will increase the utility of airplanes in general:

1. Reduction in cost of operation, or improved tactical value.
2. Improved comfort and ease of handling.
3. Greater flexibility, reliability, and convenience.
4. Reduced hazard of flying.

Performance: Hundreds of hours are involved in correction of airplane performance data to standard conditions. These tests include speed at various powers and altitudes, rate of climb, fuel consumption, propeller efficiency, and so forth, and must be repeated frequently to determine effect of various changes in configuration.

Stability and control: Wind tunnel tests provide a preliminary check on stability and control characteristics and, if properly planned, will serve to effect a great reduction in amount of flight time required for making necessary final adjustments. However, many minor changes must necessarily be tested in flight, and adequate means are needed to measure the effect of such small changes and give the answer quickly. If answer is immediately obtainable, other desirable changes may be evident, which might be inconvenient to make after waiting a week or more for results. The field of dynamic stability and control is more easily studied by means of such a flight recorder. Stability and control problems can only be perfected in flight. After approximate wind tunnel answers, final adjustments must be made on an airplane.

Structures: If the stress in every structural member of an airplane could be accurately known, the useful load of the plane might be increased by many pounds, or conversely, the possibility of a failure might be eliminated. Since the value of a pound of weight empty amounts to $200 or more to the operator throughout the life of an airplane, the measurement of stresses under actual operation conditions provides a fruitful field for flight testing, leading to improvements in cost of operation, saving in service costs, and greater safety.

Flutter and vibration: Flutter characteristics are usually determined by means of empirical methods, or by lengthy analyses with many assumptions. However, in order to be certain that flutter may be avoided with a minimum of excess weight, the conditions should be checked in flight. Ultraconservative flutter analysis may result in excess weight or, conversely, in unsafe flight characteristics. Vibration due to engine propeller combination has been the subject of careful investigation for a number of years, because of the seriousness of a propeller failure due to vibration fatigue, and because of the necessity of vibration isolation for passenger comfort. Recording oscillographs are generally used for recording such high-frequency vibrations, and these instruments have become very reliable in service, if properly attended. However, it is again unfortunate that they are not direct-recording.

Aircraft flight testing offers many peculiar problems to the engineer. In no other field of testing is there such a variety of problems, involving many interrelated variables, with swift action, and requiring continuous recording for a complete understanding of behavior. Continuous line recording is necessary properly to evaluate the variables and the dynamic effects thereof, and to permit the engineer to view the test results shortly after a run is completed and make necessary adjustments or changes.

The question may arise as to whether continuous-line recording equipment will be as accurate and dependable as standard instruments, with camera recording. The need for such recorders is sufficiently great, and the advantages are so evident that their development is justified economically. The potential saving in manpower required to correct flight data by present methods should be used to develop such instruments before the flight program starts, and in this way provide the means to obtain more flight information in a short length of time.

And count on the Bendix* Drive for action!

Many of the mechanical improvements engineered into today's jeeps will undoubtedly make their appearance in the cars of the future. But no matter how radical the coming engineering changes may be, there will always be one familiar *starting point*—the famous Bendix Drive. For just as the Bendix Drive has been successfully adapted to jeeps and countless other military vehicles of today, so it will be on hand to provide quick, sure starts for the revolutionary new automotive equipment of tomorrow.

The Bendix Drive is an important member of "The Invisible Crew"—precision equipment which more than 30 Bendix Plants from coast to coast are speeding to our fighting crews on world battle fronts.

THE INVISIBLE CREW
Precision Instruments
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*TRADE MARK OF BENDIX AVIATION CORPORATION

ECLIPSE MACHINE DIVISION

Redesigned Airliners Meeting Needs of Army

continued from page 29

A typical luxury liner converted to a military cargo airplane is the Curtiss C-46 Commando.

The main floor had to be redesigned to take a minimum uniform load, wall to wall, of 70 lb per sq ft. In the middle half of the floor this loading was increased to 100 lb per sq ft. Restricted strips were added that could carry much higher loads. Well-anchored tiedowns were needed.

The fuselage shell also came up for considerable redesign. Instead of a 30 x 72 in. passenger entrance door, a large cargo opening 96 in. long x 72 in. high had to be provided. Two cargo doors were installed in this opening, both of which open up and out. To provide an egress for the parachute troops an auxiliary door, opening in and up was installed in the forward door.

To meet the original purpose of this airplane, let us see what was accomplished. For carrying cargo, it has an unobstructed compartment 48 ft long, a maximum height of 6 ft 8 in., and a maximum width of 9 ft 10 in., with 2300 cu ft for cargo space. In addition to the main cargo compartment, compartments below the floor add 455 cu ft to the airplane capacity. These lower compartments are directly accessible from the ground through two doors, each 3 ft 5 in. wide and 2 ft 8 in. high. As an airborne task force airplane, it has provisions for 40 troops. As an ambulance plane it has provisions for 33 litters set up on removable stanchions running from floor to ceiling. Its general characteristics are:

Gross Weight, lb	45,000
Weight Empty, lb	29,483
Useful Load (available for any combination of payload to range desired), lb	15,517

New cargo airplanes released for limited publicity are:

28,000-lb Curtiss C-76 "Caravan."
33,000-lb Waco C-62.
50,000-lb Fairchild C-82.

The Fairchild C-82 and the Curtiss C-76 are primarily designed for cargo. Both are end-loading types. The general characteristics of the C-76 are:

Gross Weight, lb	28,000
Weight Empty, lb	18,500
Useful Load (available for fuel or payload), lb	9,500
Average Cruising Speed, mph	160
Maximum Fuel Capacity, gal	600

Transports that will be available in quantity for conversion to post-war use are:

Group 1. Passenger transports purchased directly from the airlines and converted for limited cargo service.

Group 2. Transports originally intended for passenger use purchased from the manufacturers with designed conversions incorporated in their basic structure for heavy cargo use.

Group 3. Transports specifically designed for heavy cargo use.

There is little information available on the fourth group, the flying boats.

The trend of the immediate post-war market for military transports is starting to appear. The airlines are showing interest in the following types of airplanes:

(a) Airplanes that can land and take off from fields much more restricted in size than those required for present-day commercial transports. The cabins have adjustable accommodations for both passengers and cargo.

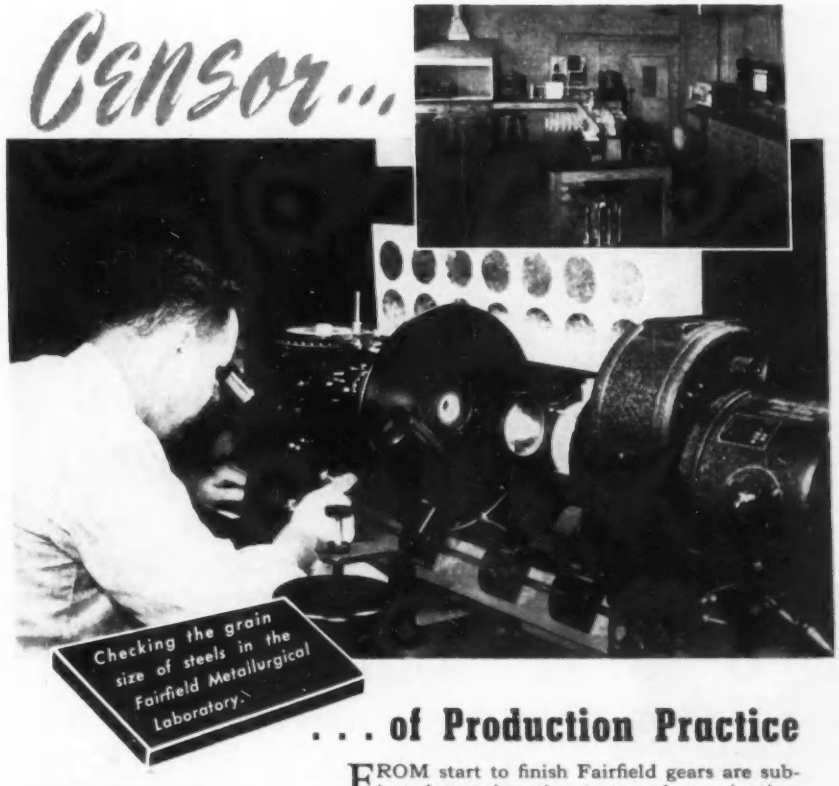
(b) Passenger airplanes with space provisions for luggage and express, operating from medium and modern fields.

(c) Airplanes having adjustable accommodations for passengers and cargo, operating from medium and modern airports.

(d) All-cargo airplanes operating from small, medium, and modern airports.

The immediate post-war market of Group 2 airplanes seems assured. Unlike Group 1 transports, these are being continually produced in factories all over the country. Group 3 transports of the C-76 Type will be in Type (a) classification, as they were primarily designed to get in and out of small fields, and due to their nose loading, a simple adjustable passenger and cargo combination can be incorporated.

Deficiencies of Group 1 and 2 transports for cargo use will be eliminated as much as is practical in designs of Group 3 airplanes.



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The use of Group 3 airplanes for Type (b) and (c) work will depend on whether the design is adaptable to carrying passengers.

Today's airplanes are not standardized as a group. Future transport designs will attempt to eliminate all deficiencies of the present cargo and passenger airplanes. This, coupled with the post-war specifications of the airlines, will spur the manufacturer on to better efforts to produce reliable, economical, and fast transports, whether they be conventional or radical in design arrangement.

Vital Role of Farm Machinery Stressed at Record Tractor Meeting

continued from page 22

like. Gasolines, he believes, will come in three principal grades:

1. A third-grade fuel of 70 to 72 octane number for left-over pre-war vehicles. This fuel will be mostly unleaded.

2. A regular or general-purpose fuel of 80 to 82 octane number, using up to 3 cc of tetraethyl lead per gal.

3. A premium-grade fuel of 86 to 88 octane number composed of 80-octane base stock aviation fuel blended with about 1 cc lead. This grade probably will also be used for small private planes.

Commercial airlines and cargo planes, he said, will use 100 octane or 100 octane plus. Diesel fuels will range from 40 to 45 cetane unless their ratings can be brought up higher by the use of additives.

Agreement with Mr. Risk's predictions also was voiced by N. D. Gjerde, Standard Oil Co. (Ind.), who presented prepared discussion. He pointed out, however, that the blending naphthas rather than the higher octane components of aviation fuels are most useful blending stocks for motor gasoline. The volume produced of such blending naphthas, however, is not sufficient to effect a marked increase in the octane number of the nation's overall motor gasoline requirements, even if all of it were used for this purpose. Since post-war requirements for aviation gasoline can be expected to be much greater than during the pre-war period, he reasoned, there can be no wholesale diversion to motor gasoline.

In answer to Chairman Schoenrock's question, Mr. Risk revealed that experiments on valve-in-head engines indicate compression ratios might go as high as 10:1.

Attention was focused on the tractor industry's fuel problems at this point by H. S. Manwaring, International Harvester Co. Conceding that gasoline is not much of a problem, he expressed his greatest concern for distillates and asked what the oil industry is planning to do to provide a uniform fuel.

In reply Mr. Larson pointed out the complication introduced by the differences in state laws in the western districts and emphasized the effect of taxation on cost. The prospect of a satisfactory distillate made to be exempt on refund from Federal excise tax was offered by Mr. Gjerde. He estimated that this fuel would have a minimum octane rating of 40, a boiling range of kerosene or better, and good starting.

This is a long-term problem, emphasized F. G. Shoemaker, Detroit Diesel Engine Division, General Motors Corp. There is a definite place in the farm industry for very low-cost fuel, he said, and the problem is to determine how to get the most out of a given amount of petroleum. This brings up the question of the kind of engine used—whether gasoline or diesel.

Following the discussion a U. S. Signal Corps motion picture, portraying the invasion of Sicily, was shown.

Tractor Tire Developments For War, Post-War Period

Improved performance over the all-reclaimed-rubber war tires being used in tractors may be expected from the new synthetics, E. F. Brunner, Goodyear Tire & Rubber Co., promised several hundred listeners in delivering his paper at the third session. Mr. Brunner was introduced by Session Chairman N. O. Panzegrau, Inter-

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national Harvester Co. However, several problems stand in the way of their widespread use for tractor tires, he emphasized, even after there is ample synthetic material available.

A uniform product must be made by the tire companies from the synthetic material coming from all plants—and each produces a material of different plasticity. There is a severe shortage of mixing equipment, because the equipment held by the tire companies is based on the requirements for pre-war natural rubber, and processing synthetic tires requires several more mixing operations than does the processing of natural rubber. The expensive molds and presses needed for the final curing operation must be used 50-75% longer for each batch of synthetic tires than for natural rubber ones, which cuts down the capacity of this equipment, too.

New machinery will not be coming in before 1944, and it will be the middle or the end of that year before the crisis is passed.

Efforts to alleviate the tire shortage have brought progress in reducing the number of standard tire sizes, but Mr. Brunner believes that simplification can be carried still further. The Tire and Rim Association has suggested that the SAE Tractor and Farm Machinery Activity consider a post-war move to possibly two rear rim diameters: for instance, 24 or 26 in. and 38 in.

Although manufacturers have had to use reclaimed-rubber tires on their wartime machinery, increased supplies of synthetics will make it possible for 1944 farm equipment to be supplied with synthetic tires. They will be, for the most part, of S3 or S5 construction, 65% synthetic and 35% reclaim, by weight.

The relative performances of various tire constructions was given by Mr. Brunner, as follows:

	Treadwear Abrasion	Cracking Cutting Chipping	Aging Checking	Carcass Bruising
Pre-war tire (crude only)	100	100	100	100
All reclaim (EF or FF)	40-50	25-40	40-50	90
War synthetic (S3 or S5)	90-95	35-50	50-60	90
Post-war synthetic (+crude)	100+	90-100	90-100	95

Another development discussed by Mr. Brunner was the tubeless tire. These have been tested by the hundreds but, before they are successful, an inner liner must be developed that will entirely prevent diffusion of the air into the tire body. This is necessary mainly because air diffusing through the inner lining slowly builds up internal pressure until the tire eventually fails. Another problem is the repair of a damaged tire so that it will hold air again.

In an effort to lick the diffusion problem, filling the tire with antifreeze solution has been tried; but this method presents a new problem in that the fluid tends to lubricate the bead, causing a chafing that eventually permits solution to enter the casing through the bead, finally causing failure.

Both partial and 100% liquid filling is being used successfully, however, on tractor tires with inner tubes to add weight so that the drawbar pull can be increased.

Although slightly more trouble, 100% liquid filling is best because it gives further increase in weight on front and rear wheels; there is no diffusion problem; there is increased drawbar pull; less bouncing occurs in rough-field operation; and pressure increases automatically for overload.

Tests show that a flexible tire will have the same inch-deflection and ground contact area under either 100% air or 100% liquid filling, and that slip, the main cause of wear, is greatly reduced by 100% liquid-filled tires, giving possibly 50 to 75% longer life to tractor tires.

If air-filled tires are not checked periodically, the resulting low pressure frequently leads to breaks in the sidewall starting on the inside and causing the tire to be ruined before the break is visible. This trouble is also eliminated by 100% liquid filling.

Discussion of Brunner Paper

Prepared discussion by H. W. Delzell, B. F. Goodrich Co., Carlton L. Zink, Firestone Tire and Rubber Co., and E. B. Munson, U. S. Rubber Co., consumed most of the discussion period.

First to be called on was Mr. Delzell, who

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To service the MECHANICS Roller Bearing UNIVERSAL JOINT, the first step is to turn down the lock plates and remove the bolts with wrench.
Specify
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Next, compress the shaft assembly in the slip joint and remove the cross and bearing assembly; which can be replaced in part, or as a complete unit. If the bearings are tight in their pilots and key seats, tap the tops of the bearings lightly, to release them.
The MECHANICS Roller Bearing UNIVERSAL JOINT is a precision made unit that is giving long, trouble-free service in the Nation's leading cars, trucks, busses, tractors and military vehicles. However, should it ever become necessary to replace a worn cross or bearing — all that needs to be done is to turn down the lock plate on the bolts holding the four bearings to the two yokes; remove the eight bolts; compress the shaft assembly in the slip joint; and remove the cross and bearing assemblies. The simple, efficient design of the MECHANICS Roller Bearing UNIVERSAL JOINT makes possible unusually quick, easy servicing and reassembling — on the road or in the field — in a few minutes — thus avoiding the hours of delay caused by having to take a less conveniently serviced universal joint assembly to a repair shop.
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When reassembling, it may be necessary to tap the bearing, as shown, to compress the cork packing between the bearings and the trunions. This will permit entry of the bearing in the pilot of the yoke. Make sure that the trunion bearings are drawn up tightly against the yoke faces and all bolts are tightened and locked securely.
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considered the position of synthetic rubber in the post-war picture. He pointed out that, even though the Far Eastern rubber plantations are soon recovered from the enemy, it may require several years after hostilities cease to put the plantations in condition to equal pre-war production. This means then that, for some time to come, America must rely to a great extent on synthetic rubber.

Although conceding that synthetic-rubber tractor and implement tires produced at present are not yet equal to pre-war tires made from natural rubber, he pointed out that new things are obsolete before they reach maturity and that "there is every reason to believe that, with advancements in the art of producing and compounding synthetic rubber, tractor and implement tires made from this material may eventually be superior to those made from crude rubber."

From an economic standpoint, Mr. Delzell continued, it is reasonable to expect that natural rubber will be cheaper, pound for pound, than synthetic rubber, but it is entirely possible that the cost *per mile of service* may be lower for synthetic tires than for those made from natural rubber. If sound policies are followed in the production and pricing of crude rubber after the war, he predicted that synthetic rubber will have a definite stabilizing effect on the price of all rubber after the war, resulting in a lower production cost from goods made from either natural or synthetic rubber.

Liquid Filling of Tires

Turning to the subject of liquid filling of tires, Mr. Delzell contended that, although there is some advantage gained by completely filling the tires with liquid and reducing the inflation pressure loss, tests have proved that the bruise resistance of tires filled with liquid 90 or 100% is considerably reduced over a tire inflated with air or filled with liquid to the valve level.

Commenting on the benefits of reducing manufacturing costs by standardization and simplification of tire sizes, Mr. Delzell concluded that the tire industry appreciates the whole-hearted cooperation given this program by the tractor and implement industry.

Mr. Zink confined his remarks to tubeless tires and liquid filling of tires with tubes. The additional cost of the rubber innerliner used to prevent the liquid filling from coming into contact with the cords of tubeless tires, he contended, absorbs a material portion of the saving made by eliminating the inner tube. In addition there are definite indications that calcium-chloride solutions or even water alone deteriorate the cord body of the tire. Punctures in the tubeless tires expose the cords to the harmful effects of the liquid. The bead-to-rim seal is easily destroyed by tire tool damage, and even slight leakage at the bead keeps the rim wet which, in turn, causes rapid rusting.

On the subject of liquid filling, Mr. Zink contended that "there is no difference in drawbar pull whether the additional weight is applied in the form of cast-iron weights, cast wheels, concrete, water, calcium-chloride solution, bags of sand, slabs of steel, mounted implements, weight transfer, or what have you. There are, of course, factors of convenience, cost and expediency to be considered and, as a result, the use of cast-iron weights and the partial or total filling of tires with liquid are popular. We do not feel that it is desirable to work toward a hard, unyielding tire that, when it reaches its ultimate, is much the same as a cast iron wheel with lugs on it."

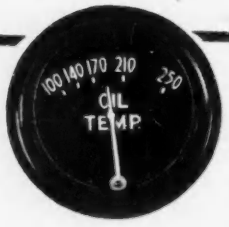
Disadvantages of Liquid Filling

Mr. Zink then displayed test figures which showed that, under identical test conditions, the magnitude of the jolt produced by 100% liquid-filled tire was about 2½ times greater than that of an equivalent air-filled tire.

Disadvantages of tubeless tires and liquid filling mentioned previously were given support in Mr. Munson's prepared discussion. "Our experience," he reported, "has been that no reasonable amount of rubber applied to either the 'band' or inner ply, or between the inner plies, would prevent diffusion. Because the air diffuses into the tire, it has a detrimental effect causing side wall blisters and tread separations. It is doubtful whether or not there can be any substantial economy from a material and labor standpoint."

With reference to liquid filling Mr. Munson said: "Our tests show that a tractor tire 100% filled with liquid ballast has 25% less bruise resistance than when inflated with air."

How much original accuracy do your Gauges still retain?



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Rochester Gauges aren't burdened with complicated parts . . . gears, links, cams, tubes and hairsprings aren't part of their design. You don't have to wonder about how much of the truth they're telling you—each gauge must pass the high Rochester inspection standards. Rochester Gauges are put in ACCURATE calibration *individually* and *permanently*.

There are Rochester Gauges for Fuel and Lubricating Oil Pressures and Temperatures, Liquid Level Gauges, highly sensitive Ammeters and Pressure-tight Magnetic Type Gauges for LP-Gas Systems that are listed as standard by underwriters.

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Possibilities of "Needle" Steels Appraised at Final Session

The organization and achievements of the SAE Tractor War Emergency Committee in assisting Government agencies to solve wartime engineering problems were summarized by its chairman, A. W. Lavers, Minneapolis-Moline Power Implement Co., in the first paper of the final technical session, which will be published in full in an early issue of *SAE Journal*.

Fresh data on special-addition-agent or "needle" steels were revealed in the second paper by a leading authority on the subject—R. B. Schenck, Buick Motor Division, General Motors Corp. (Mr. Schenck's paper, "Special Addition-Agent Steels," is published in full beginning on p. 385, Transactions Section, this issue.) A packed attendance of metallurgists and engineers representing both users and makers of steels reflected the growing interest in results and future possibilities of this development. L. S. Pfost, Massey-Harris Co., served as session chairman.

Discussion of Schenck Paper

The "constantly changing picture on our conceptions of acceptable steels" was the subject of speculation by J. T. Jarman, Allis-Chalmers Mfg. Co., who read from prepared discussion.

NE Steels in Post-War Period

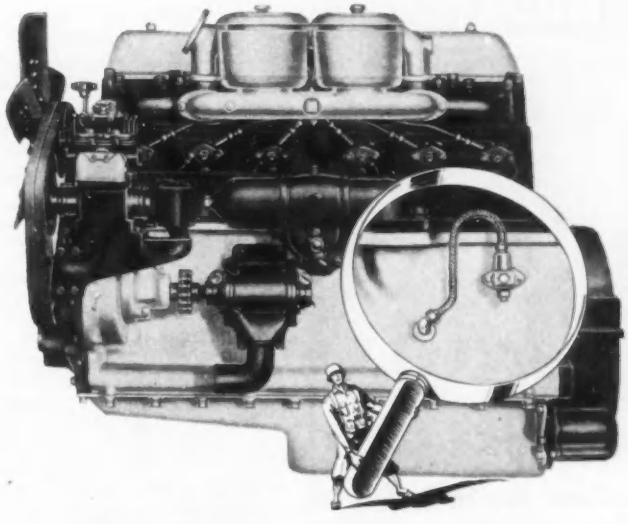
"There is no question," Mr. Jarman declared, "that there are many interesting days ahead for engineers and metallurgists who have to watch quality and cost of applied steels. Now we have NE steels, some of which will be with us permanently, as such or in some slightly modified form. . . . The 'needled' steels, if proper specifications for general use prove satisfactory, are going to find their place in the overall picture. After this emergency, I believe we all can picture what an undercover fight there will be for a place in the nation's special steel applications. Nationally known metallurgists have been instrumental in changing the old easy-going conceptions of acceptable steels. The data presented this afternoon give practical and applicable methods for initiating such changes. For the general consumer these easily understandable methods must be kept in mind in the adjustable stage after the war. For the immediate picture, since a large saving in alloys is possible with the 'needled' method and a potential satisfactory general specification is in the offing, it behooves us engineers and metallurgists to pay strict attention to this development, as some of our richer NE steels might be going out the window."

"Fade-out" of Needle Steels

Mr. Jarman also declared he had heard reports that some needle steels tend to "fade out" and that fading out is more prevalent with ladle additions than with ordinary steels. If such a characteristic is possible, he asked, is it, as the word implies, a gradual process or is there a relatively abrupt change? In reply Mr. Schenck told him that such a tendency to fade out had not proved serious in his experience to date and that, in his opinion, it could be controlled by suitable measures.

Supplementary information on alloy steel developments was provided by H. B. Knowlton, International Harvester Co., the next to present prepared discussion. He emphasized throughout his discussion that, although needle steels may solve many of the metallurgist's problems for certain applications, they may prove unsuitable for others. The stresses in the parts and their distribution must be determined to find out what is really required of the steel. The NE steels, he pointed out, were produced almost entirely to meet hardenability requirements but hardenability is not the sole criterion. Mr. Knowlton then displayed curves showing the results of torsional fatigue tests on axles made of needle steels as compared with those made from regular steels. These tests indicate, he concluded, that addition-agent steels containing little alloying element are going to stand up in this service.

H. Bornstein, Deere and Co., voiced his belief that needle steels have definite possibility for the farm equipment industry. He indicated that this possibility will become a probability if needle steels are classified as carbon steels instead of alloy steels.



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In reply to the inquiry of W. A. Silliman, Cleveland Tractor Co., with reference to getting samples of needle steels for tests, Mr. Schenck reported that companies could either order a complete heat from the steel company, split up a heat among a number of companies, or get together in a cooperative testing program. After the material is ordered, he warned, delivery takes close to a year.

Replying to the question of L. E. Webb, Frost Gear and Forge Division, Clark Equipment Co., Mr. Schenck reported that needled cast steel is being used successfully quenched and drawn.

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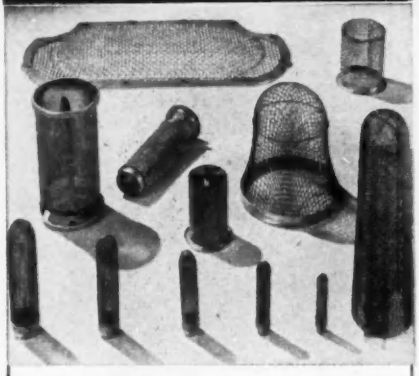

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Cold Operation

SAE Program Wins Praise from Army

IMPORTANT engineering progress on the Ordnance Department's program for cold weather operations of motor vehicles was reported by the Tank-Automotive Center in Detroit, Sept. 15, when Lt.-Col. J. M. Colby, chief, Development Branch of the T-AC staged for Army officers a preview inspection of equipment thus far developed. Civilian engineers, including many SAE members, were shown the equipment on the following day. (See pictures on page 41.)

The Colonel complimented the work of the Cold Operations Committee of the SAE War Engineering Board, of which Roy E. Cole, vice-president in charge of engineering of Studebaker Corp., is sponsor, and W. S. James, Studebaker chief engineer, is chairman. Much of the winterization equipment developed by the Ordnance Department to improve operation of vehicles in sub-zero temperatures, was the result of the committee's recommendations, Col. Colby told the group of high ranking officers and military engineering officers. Several British officers were present.

In addition to a group of vehicles shown, a display had been made of the winterization kits. The winterization equipment was painted red for ready identification.

To advance the program by obtaining first hand information of the effectiveness of various types of equipment, the committee's members again will participate in tests in the far North this fall and winter, but smaller groups will attend because of limited facilities. Members will have to submit to military discipline and live as soldiers do, Col. Colby warned.

About SAE Members

continued from page 33

apolis) to representative for industrial products; **TORRANCE B. SMITH,** American Brass Co., from assistant manager (Detroit), to manager, Development and Engineering Department, Waterbury, Conn.; **RICHARD K. KOEGLER,** Airplane Division, Buffalo Plant No. 2, Curtiss-Wright Corp., Cheektowaga, N. Y., from assistant to head of engineering structures.

WILLIAM LOUIS EFFINGER, JR. is now an ensign in the U. S. Navy. As a civilian, he had been president of Berkeley Models, Inc., Brooklyn, N. Y.

Formerly executive vice-president, United Aircraft Products, Inc., Dayton, Ohio, **CLEEMANN WITHERS** is now vice-president, Gray Mfg. Co., Hartford, Conn., manufacturers of electronic equipment.

T. W. LORING has been re-transferred to his former position as body engineer, Oldsmobile Division, General Motors Corp., Lansing, Mich. He had been assistant chief engineer, Eastern Aircraft Division, General Motors Corp., Trenton, N. J.

WILLIAM M. KLOMPAS is air engineer with the Canadian Pacific Airlines, Ed-

SAE student members newly engaged in engineering work at various production plants throughout the country include:

MAX GREITZER	New York University	Design Draftsman Modern Engineering Co. New York City
JOHN D. WATSON, JR.	University of Wisconsin	Draftsman Douglas Aircraft Co., Inc. El Segundo, Calif.
CONSTANTINE GAVRAS	Detroit Institute of Technology	Junior Electrical Engineer National Advisory Committee for Aeronautics Ames Aeronautical Laboratory Moffett Field, Calif.
THOMAS T. SCHROETER	University of Texas	Junior Engineer Wright Aeronautical Corp. Paterson, N. J.
GEORGE J. MONCHER	College of the City of New York	Experimental Engineer Chrysler Corp. Highland Park, Mich.
CHARLES NEGULICI	Ohio State University	Junior Mechanical Engineer National Advisory Committee for Aeronautics Cleveland Airport
RAYMOND NARLOCK	University of Wisconsin	Armament Design Group Douglas Aircraft Co. Inc. El Segundo, Calif.
KARL L. PENNAU	University of Wisconsin	Inspection Department Kimberly-Clark Ordnance Division Neenah, Wisconsin
RALPH P. HORAN	College of the City of New York	Experimental Engineer Chrysler Corp. Highland Park, Mich.
WILLIAM A. FLEMING	Purdue University	Junior Engineer National Advisory Committee for Aeronautics Cleveland Airport

monton Alta., Canada. He was formerly connec with the McKenzie Air Service in the sa city.

HEL UTH G. BRAENDEL'S position at Contin tal Motors Corp., Detroit, has been change from supervisor of the dynamometer laborat y, to chief development engineer.

MA RICE A. BRISCOE has left the Dodge Chicago Plant, Division of Chrysler Corp., and is now senior checker, central engineering department, General Motors' Fisher Body Division, Detroit.

JOHN E. CANOOSE, diesel officer in the U. S. Navy, Navy Yard, Brooklyn, N. Y., has been promoted from lieutenant-commander to commander.

Formerly vice-president, D. A. Stuart Oil Co., Ltd., Chicago, **TRACY B. LANGDON** is now manager, Lubricants Division, American Oil & Supply Co., Newark, N. J.

RAYMOND K. BOWDEN has been transferred from the Chicago to the Pittsburgh branch of Carnegie-Illinois Steel Corp., where he is director of quality control.

Previously vice-president of engineering, Britton Controls, Inc., Cleveland, **KARL B. BRITTON** is now in the Development Engineering Department, Thompson Products, Inc., Cleveland.

ALBERT A. ARNHYM is now consulting engineer, Solar Aircraft Co., San Diego, Calif. He had been chief engineer, Pacific-Airmax Corp., Huntington Park, Calif.

Among the SAE members appointed to the Aluminum Foundry Industry Advisory Committee of the War Production Board are **E. G. FAHLMAN,** president, Permold Co., Medina, Ohio; **A. J. LANGHAMMER,** president, Amplex Division, Chrysler Corp., Detroit; **RANDOLPH J. ROSHIRT,** general manager, Bohn Aluminum & Brass Corp., Detroit, and **HARRY L. SMITH, JR.,** product manager, Aluminum Co. of America, Cleveland. Frederick Ayer II is Government presiding officer.

K. R. WILSON, president, K. R. Wilson Co., Buffalo, has been appointed a member of the Automotive Maintenance Equipment Industry Advisory Committee of the War Production Board, J. J. Donovan, Automotive Division, announced.

ENSIGN ROBERT J. REEL. USNR, is at the U. S. Naval Training Station at Great Lakes, Ill. Ensign Reel was formerly a student at Ohio State University.

Formerly in the Maintenance Section of the U. S. Army, Inspection General's Department, Washington, **CAPT. PHIL C. FAITH** is now at the Red River Ordnance Depot, Texarkana, Tex.

Formerly president of the Salta Corp., Jersey City, N. J., **WESLEY L. SMITH** is now vice-president of Great American Industries, Inc., New York City.

ENSIGN W. MANN, USNR, is at the Flight Test Naval Air Station, Patuxent River, Md. He had previously been at the U. S. Naval Training Station at Great Lakes, Ill.

H. P. CROFT, who had been assistant director of research, Cleveland Mill Division, Chase Brass & Copper Co., Inc., Euclid, Ohio, is now a lieutenant colonel in the Ordnance Department of the U. S. Army, with headquarters in Cleveland.

Among speakers discussing present and future air transport problems at a national meeting of the Institute of Aeronautical Sciences of New York at the Hotel Statler, Washington, Oct. 26, were: **COL. H. R. HARRIS,** commanding officer of Domestic Transportation Division of Air Transport Command; **WILLIAM LITTLEWOOD,** vice-president in charge of engineering, American Airlines, Inc., La Guardia Field, New York; and **GROVER LOENING,** consultant on aircraft, War Production Board.

FRANK F. KERNS, formerly test supervisor for Guiberson Diesel Engine Co., Garland, Tex., is now with Guiberson Corp., Dallas, Tex.

Previously field engineer, Sterling Aircraft Products, New York City, **ROLAND S. ELY** is now engineering laboratory supervisor for AiResearch Mfg. Co., Inglewood, Calif.

ROBERT G. GLASS has been appointed vice-president and manager of operations and a director of the Geneva Steel Co., a new Utah subsidiary of United States Steel Corp. Mr. Glass had been assistant manager of operations, Chicago branch of Carnegie-Illinois Steel Corp.

CLOYD DICKERSON has been named a test engineer for Rolls-Royce Division, Pack-

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ard Motor Car Co., Detroit.

Formerly tooling superintendent at Timm Aircraft Corp., Van Nuys, Calif., **W. D. LEWIS** is now associated with L. D. Reeder Co., Los Angeles.

ROBERT Y. COPLAND, who was production manager in the Tire Division of U. S. Rubber Co., New York City, has been transferred to the engineering department.

A. JORDANOFF, president of Jordanoff Aviation Corp., New York City, spoke at a meeting of the Notre Dame Club of the City of New York at the Hotel Commodore, Oct. 14. The subject of his discussion was "Visual Instruction: the Key to Post-War World Construction."

OBITUARIES

William S. Harley

William S. Harley, co-founder, chief engineer and treasurer of Harley-Davidson Motor Co., died suddenly Sept. 18 at the age of 63. A pioneer and leader in the field of motorcycling, Mr. Harley, who was a graduate of the University of Wisconsin, was aided in his experiments with new designs by his childhood friend and partner, Arthur Davidson. He served on the Competition Committee of the American Motorcycle Association for 24 years, and was also a member of the Business Men's Sketch Club of Milwaukee.

D. A. Andrews

D. A. Andrews, division sales manager of Continental Motors Corp., Detroit, died on Oct. 3. Mr. Andrews, who had been a member of the SAE since 1925, was 58 years old.

Eugene Gruenewald

Eugene Gruenewald, president of Ross Gear & Tool Co., died suddenly on Oct. 1 while on vacation. A member of the SAE since 1910, Mr. Gruenewald had been associated with Ross for the last 21 years. Previously he had been general manager of R and V Engineering Co., Moline, Ill., builders of sleeve valve engines.

Charles Paul Teeple

Dr. Charles Paul Teeple, vice-president and director of research of the Crane Packing Co., died recently as the result of an accident sustained while experimenting in his laboratory. He had a doctor's degree in metallurgy from the University of Michigan, and was a pioneer in the development of the mechanical packing industry.

Erving R. Gurney

Erving R. Gurney, designing engineer of United Aircraft Corp., and an SAE member since 1910, died of a heart attack on Sept. 14 at the age of 66.

Henry C. Pierle

Henry C. Pierle, secretary and sales manager of R. K. Le Blond Machine Tool Co., died recently. He had attended the University of Cincinnati, and had been an associate member of SAE since 1929.

C. N. Gammage

C. N. Gammage, vice-president and general manager of Hayes Steel Products, Ltd., producers of automotive parts and forgings, died recently at the age of 55. Mr. Gammage had been connected with that company since 1920.

Louis C. Marburg

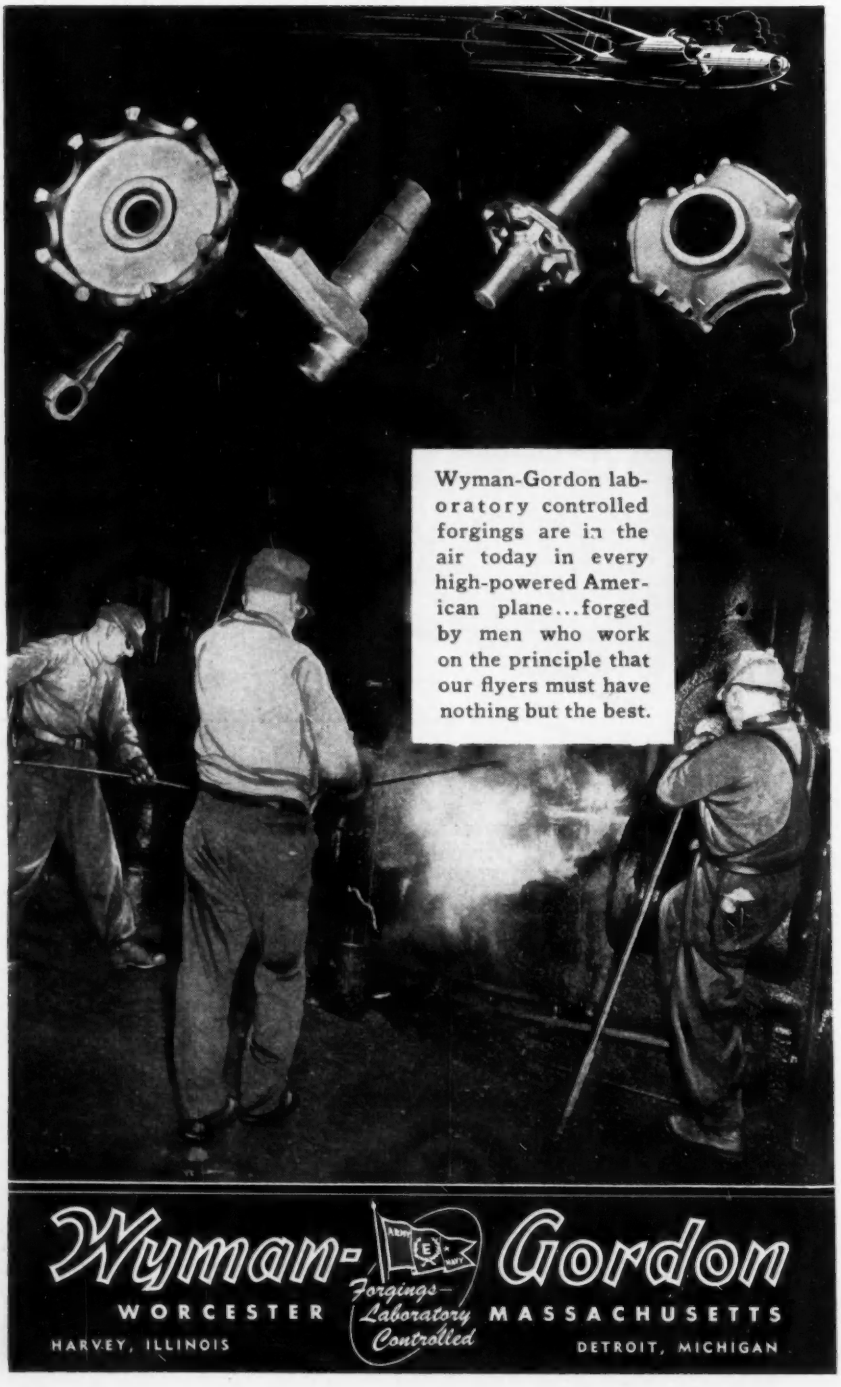
Louis C. Marburg, secretary and treasurer of Marburg Bros., Inc., engineering and importing firm, died recently. Mr. Marburg, who had attended the Colleges of Charlottenburg at Hanover and Darmstadt, Germany, was 67 years old.

Eric Nygard

Eric Nygard, who had been connected with the Scintilla Magneto Division, Bendix Aviation Corp., died recently at the age of 51. He was a graduate of the University of Washington, where he received his degree in electrical engineering.

Angus MacKinnon Campbell

Angus MacKinnon Campbell, chief engineer and chief pilot of M & C Aviation Co., Ltd., and chief engineer of Aircraft Skis, Ltd., both in Prince Albert, Saskatchewan, Canada, died recently. He had been conducting experiments aimed at improving the cycle of the gasoline engine to obtain greater fuel economy.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